THE

SILVA OF NORTH AMERICA

BY

CHARLES SPRAGUE SARGENT

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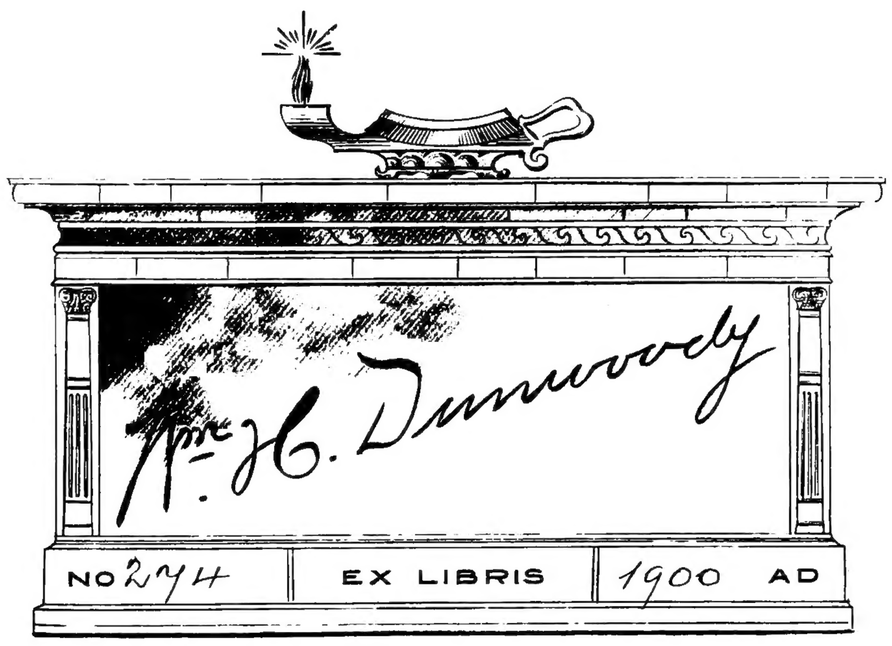

THE

SILVA OF NORTH AMERICA

A DESCRIPTION OF THE TREES WHICH GROW NATURALLY IN NORTH AMERICA EXCLUSIVE OF MEXICO

BY

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Illustrated with Figures and Analyses drawn from Nature

BY

CHARLES EDWARD FAXON

VOLUME X

LILIACEÆ — CONIFERÆ

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TO

ÉDOUARD-FRANÇOIS ANDRÉ

ARTIST, EXPLORER, AND STUDENT OF PLANTS

THIS TENTH VOLUME OF

THE SILVA OF NORTH AMERICA

IS AFFECTIONATELY DEDICATED

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SYNOPSIS OF THE ORDERS OF PLANTS CONTAINED IN VOLUME X. OF THE SILVA OF NORTH AMERICA.

CLASS II. **MONOCOTYLEDONOUS or ENDOGENOUS PLANTS.**

Stems with woody fibres distributed irregularly through them. Leaves mostly parallel-veined. Embryo with a single cotyledon.

55. **Liliaceæ.** Flowers perfect, 6-androus. Ovary superior, usually 3-celled. Ovules 2 or numerous. Fruit 3-celled, capsular or baccate.

56. **Palmæ.** Flowers perfect, 6-androus. Ovary superior, 1 to 3-celled. Ovule solitary. Fruit 1 or rarely 2 or 3-seeded, baccate or drupaceous.

CLASS III. **GYMNOSPERMÆ. Resinous trees or shrubs.**

Stems increasing in diameter by the annual addition of a layer of wood inside the bark. Flowers unisexual, naked. Stamens numerous. Ovules 2 or many not inclosed in an ovary. Cotyledons 2 or more. Leaves usually straight-veined, persistent or deciduous.

57. **Taxaceæ.** Flowers dicœcious or rarely moncœcious, axillary, solitary or umbellate. Ovule 1. Fruit surrounded by or inclosed in the enlarged fleshy aril-like disk of the flower. Cotyledons 2.

58. **Coniferæ.** Flowers monœcious, usually solitary, terminal or axillary. Ovules 2 or many. Fruit a woody or rarely fleshy strobile. Cotyledons 2 or many. Leaves scale-like, linear or subulate, solitary or clustered.

SILVA OF NORTH AMERICA.

YUCCA.

FLOWERS perfect; perigone 6-parted, the segments more or less united at the base; stamens 6; ovary superior, 3-celled; ovules numerous in each cell, horizontal. Fruit baccate, fleshy and indehiscent, or capsular and dehiscent. Leaves clustered at the summit of the stem, linear-lanceolate, entire, serrate or filamentose, exstipulate, persistent.

Yucca, Linnæus, *Gen.* 99 (1737). — Adanson, *Fam. Pl.* ii. 49. — A. L. de Jussieu, *Gen.* 49. — Endlicher, *Gen.* 144. — Meisner, *Gen.* 398. — Engelmann, *Trans. St. Louis Acad.* iii. 17. — Bentham & Hooker, *Gen.* iii. 778. — Engler, *Engler & Prantl Pflanzenfam.* ii. pt. v. 70.

Codonocrinum, Willdenow, *Roemer & Schultes Syst.* vii. pt. i. 718 (1829).

Plants, with endogenous stems subterranean or barely emerging from the surface of the ground, or sometimes rising into tall simple or branched columnar trunks covered with dark thick corky bark, light fibrous wood in concentric layers, thick stoloniferous saponaceous root-stocks and thick rootlets, or long tough stout roots. Buds naked, in the axils of upper or of lower leaves, ovate, acute, flattened by pressure against the leaves, their lowest leaves white, scarious, and early deciduous, prolonging the stem after the death of its apex with the terminal inflorescence, often remaining dormant in the stem for years, and then producing lateral clusters of leaves. Leaves involute in the bud, alternate, mostly closely imbricated at the summit of the stem, erect at first, becoming reflexed,[1] elongated, linear-lanceolate, abruptly narrowed above the broad-clasping often much thickened base, usually widest near or above the middle, concave and involute toward the apex below the horny usually sharp-pointed, rarely obtuse, occasionally soft and herbaceous, terminal spine, thick and ridged or thin and flaccid, more or less concave and sometimes deeply channeled on the upper surface, convex and usually bluntly keeled toward the base on the lower surface, smooth or scabrous, the margins serrulate with small remote irregular cartilaginous teeth, or roughened while young with minute deciduous knobs and soon becoming discolored and brittle, or filamentose by the separation of the marcescent marginal fibres into thick or thin, straight or curved, white or reddish threads, bright or dull green or glaucous, persistent for one or many years, exstipulate. Flowers slightly fragrant or strong-smelling, entomophilous,[2] produced in large many-flowered terminal compound glabrous pubescent or tomentose

[1] The reflexion of the leaves of *Yucca aloifolia* and other species as studied by Webber (*Rep. Missouri Bot. Gard.* vi. 98) is contemporaneous with the completion of the definite growths or phytomeroids of the stem, only the leaves of the last phytomeroid being erect. After this has produced its panicle of flowers and fruits, or in about two years after the appearance of the bud at the base of the panicle of the previous growth, the leaves on this terminal phytomeroid all begin slowly to reflex, and, becoming more and more dependent and depressed against the stem, and finally dying at the end of several years, remain for several years more on the plant.

[2] The structure of the flower of Yucca, with stamens shorter than the ovary, precludes self-fertilization, and the large pollen-masses cannot reach the stigmatic tube except through the agency of insects. Only one species is known to produce fruit when transferred from its native region and deprived of the visits of the

erect or rarely pendulous panicles, or occasionally in simple racemes or spikes; panicles nearly sessile or raised on short or elongated peduncles furnished with leaf-like bracts; bracts of the inflorescence ovate, acute or acuminate, concave, thick and fleshy, white, often more or less tinged with purple, decreasing in size from below upward, those subtending the pedicels thin and scarious; pedicels in two or three-flowered clusters, or single at the base of the panicle, simple or rarely forked near the middle, shorter than the flowers, curved, slightly spreading, pendulous, ebracteolate. Perigone cup-shaped, composed of six segments in two series, more or less united at the base into a short tube, expanding in the evening for a single night, marcescent;[1] segments thick, ovate-lanceolate, creamy white or white tinged with green, and often flushed with purple on the back, usually furnished at the apex with small tufts of white hairs, those of the outer rank narrower, shorter, and more colored than the more delicate and petaloid segments of the inner rank. Stamens six, in two series, hypogynous, free or adnate to the base of the segments of the perigone, usually shorter than the ovary, white; filaments clavate, fleshy, obtuse and slightly three-lobed at the apex, covered, especially above the middle, with one-celled transparent hairs, or acute at the apex and glabrous (Hesperoyucca), erect before anthesis, becoming recurved after the maturity of the anthers; anthers sagittate or cordate at the base, rounded, entire or emarginate at the apex, glabrous, or furnished with tufts of apical hairs (Hesperoyucca), attached on the back, introrse, two-celled, the cells opening longitudinally, curling backward, and expelling the large globose powdery or agglutinated pollen-grains. Ovary superior, sessile or rarely stipitate,

peculiar moths which are necessary to insure the fertilization of the flowers of these plants. This is *Yucca aloifolia* of the south-eastern United States, whose flowers are better adapted than those of the other species for self-fertilization. The stigmatic lobes are sessile, and the stigmatic liquid is abundant, often overflowing from the stigmatic tube, so that there is a chance that the pollen-grains may be carried accidentally from the comparatively longer stamens to the stigmatic secretions, or may fall on the papillose apex of the stigmatic lobes; and this species often fructifies abundantly in cultivation in regions where the Yucca Moth does not exist, although in a case where the flowers were protected from the visits of all insects they were not fertilized. (See Riley, *Rep. Missouri Bot. Gard.* iii. 118.)

So far as is now known, the flowers of all the species of the region east of the Rocky Mountains are fertilized by females of a nocturnal moth, *Pronuba yuccasella*, Riley (*Trans. St. Louis Acad.* iii. 56, f. 2); in California the flowers of *Yucca arborescens* are fertilized by *Pronuba synthetica*, Riley (*l. c.* 141, t. 41, f. 1, 2, t. 43, f. 1), and those of *Yucca Whipplei* by *Pronuba maculata*, Riley (*Proc. Am. Ass. Adv. Sci.* xxix. 633 [1881]; *Rep. Missouri Bot. Gard.* iii. 139, t. 42, f. 2). When the perigone opens in the evening, the anthers split and discharge the pollen-grains which adhere in the anther slits. The female moth now enters the flower and begins to gather the pollen with her peculiar maxillary prehensile spinose tentacles, visiting the stamens in turn, and forming a ball of pollen often three times as large as her head. When this is completed she visits a flower of another plant, selecting one that has just opened or which had opened during the previous night, and bearing her load of pollen held by the rolled-up palpi below and close to the head. In entering the flower she brings her abdomen against the pistil, with the body between two of the stamens, which she straddles with her legs, the head being usually turned toward the stigma, and in this position she pierces the ovary obliquely just below the middle, and deposits an egg with her ovipositor in the ovarian cell next the placenta. When the egg is deposited she slowly withdraws her ovipositor, and then runs to the tip of the pistil and pushes the ball of pollen collected in another flower down into the stigmatic tube. This operation she usually performs after depositing each egg, although two or three eggs are occasionally laid before the pollen is transferred to the stigmatic tube. The larva hatches at the end of a week, and soon enters one of the developing ovules by its funicular base; it matures with the ripening of the seeds, of which it has destroyed a dozen or less during its growth, and just before the fruit ripens it bores its way out, and reaches the ground, probably by the aid of a silken thread. Penetrating the soil to the depth of several inches, the larva then spins a tough silky cocoon, in which it remains until a few days before the Yuccas bloom in the following year, when it is transformed into a chrysalis armed on the head with an acute spine, and on the back with spatulate spines, by means of which it works its way to the surface of the ground, and the moth emerges. This wonderful correlation between the insect and the flower is all the more remarkable because the insect does not derive any direct benefit from it. She does not visit the flower in search of food and incidentally transfer the pollen from the stamens to the stigma. The flowers of Yucca either produce no nectar or produce it in the smallest quantity, and the Pronuba does not feed upon the pollen. Her labors appear to be purely maternal, and her only object in gathering the pollen of one flower and thrusting it down the stigma of another seems to be the development of the seeds which are to supply her offspring with food. The action of this insect in fertilizing the flowers of Yucca, first noticed by Dr. George Engelmann, has been carefully studied by Professor C. V. Riley, and by Professor William Trelease, who has visited many of the species of Yucca in their native homes for the purpose of watching their pollination. (See Engelmann, *Bull. Torrey Bot. Club*, iii. 33; *Trans. St. Louis Acad.* iii. 28. — Riley, *Trans. St. Louis Acad.* iii. 55; *Rep. Missouri Bot. Gard.* iii. 99. — Kerner von Marilaun, *Pflanzenleben*, ii. 155, f. 1–5. — Trelease, *Rep. Missouri Bot. Gard.* iv. 181.)

[1] The flower of Yucca expands during the evening into a more or less widely opened bell, and soon after sunrise the next morning begins to close by the gradual bending in of the points of the segments, which, during the next two or three days, form a bladder-like perianth with six broader or narrower openings between the segments, and then withers and dries up.

obscurely six-sided, nectariferous,[1] glabrous, dull greenish white, three-celled, the cells divided by the development from the back of the carpels of secondary dissepiments, obtuse, or gradually narrowed into a short or elongated three-lobed style, the lobes emarginate and bilobed at the apex, ivory-white, and clothed with short epidermal hairs, and forming a broad triangular stigmatic tube, or slender and elongated, and crowned with a capitate three-lobed hyaline-papillate stigma penetrated by a narrow stigmatic tube (Hesperoyucca); ovules in six series, numerous, compressed, horizontal, short-stalked, anatropous. Fruit oblong or oval, more or less distinctly six-angled, six-celled, pendulous or erect, usually more or less beaked at the apex, surrounded at the base by the remnants of the perigone, baccate and indehiscent, or capsular, three-valved and dehiscent, dividing as it opens through the primary dissepiments, the valves finally splitting at the apex, or through the carpels loculicidally (Hesperoyucca); pericarp of two coats, the outer at maturity thick, succulent, and juicy (Sarcoyucca), or thin, dry, and leathery, and usually easily separable from the firm membranaceous or rarely succulent inner coat (Clistoyucca), or thin and woody, and adherent to the rather thinner membranaceous endocarp (Chænoyucca and Hesperoyucca). Seeds compressed, triangular, obovate or obliquely ovate or orbicular, thick with a narrow two-edged rim, or thin with a wide or narrow brittle margin; testa thin, more or less opaque, black, slightly rugose or smooth.[2] Embryo straight or more or less curved, diagonal, in plain or rarely ruminate hard farinaceous and oily albumen;[3] cotyledon much longer than the short radicle turned toward the small oblong white hilum.[4]

[1] Septal nectar glands occur within the partitions which separate the cells of the ovary of Yucca, forming thin pockets extending from its summit nearly to the base, open at the apex, and, pouring their scanty secretions down through a capillary tube, discharge them through pores at the bottom of the ovary and opposite the inner segments of the perigone. (See Trelease, *Bull. Torrey Bot. Club*, xiii. 135, f. See, also, Brongniart, *Ann. Sci. Nat.* sér. 4, ii. 9 [*Mém. sur les Glandes Nectarifères de l'Ovaire*].)

[2] The three types of the fruit of Yucca correspond with three distinct methods by which the seeds are disseminated. In the first group (Sarcoyucca) the ripe fruit is thick, sweet, and pulpy, and is easily separated from the hard firm and core-like endocarp which closely invests the seeds. The fruits of this group, protected like those of all the arborescent species from the attacks of climbing animals by the decumbent sharp-pointed lower leaves, fall as soon as ripe, with the exception of those of *Yucca aloifolia*, while the succulent flesh is tempting to small animals and to birds, who, in carrying it away, disseminate the seeds. In *Yucca aloifolia* the endocarp becomes succulent at maturity, and the fruit does not fall when ripe, but dries up on the panicle when it is not eaten by birds, especially by the mocking-bird, who in feeding upon the pulp swallows many of the seeds, which it voids without affecting their vitality, and appears to be one of the principal agents for the dissemination of the seeds of this species. (See Webber, *Rep. Missouri Bot. Gard.* vi. 96.)

The distribution of the seeds of *Yucca aloifolia* is also assisted by the larvæ of the Bogus Yucca Moth (*Prodoxus decipiens*, Riley). The eggs of this moth are deposited in the stalk of the young flower panicle, in which the larvæ burrow, and by their activity when preparing to hibernate late in the autumn when the fruits are dried up often cut it through, and, causing the panicle to fall to the ground, insure the spreading of the seeds. (See Webber, *l. c.* 103.)

In the second group (Clistoyucca) the thick exocarp of *Yucca arborescens* becomes thin, dry, and spongy at maturity, and the lightness and roundness of the fruits which fall easily enable the wind to blow them about over the desert, thus breaking the pericarp and scattering the seeds.

In the fruit of the capsular species (Chænoyucca and Hesperoyucca) the pericarp becomes woody at maturity, splits through the centre and at the apex through the backs of the carpels, or opens loculicidally, allowing the thin seeds to escape from the erect capsules sometimes raised high in the air. (See Trelease, *Rep. Missouri Bot. Gard.* iv. 223.)

[3] In germinating, the cotyledon remains partly under ground and within the seed, and does not grow into a leaf organ, the first leaf issuing from a split in the cotyledon opposite the remnants of the seed, and the leaves of the first season being in $\frac{1}{2}$ order. From the nodes of the first axis stout rootlets break through the back of the leaves, the earliest coming from the back of the cotyledon opposite the first leaf, and the radicle withers, or, in Hesperoyucca, the axis with the bases of the leaves swells out into a thickened bulb-like mass (Engelmann, *Trans. St. Louis Acad.* iii. 20).

[4] By Engelmann (*l. c.* 34) the species of Yucca are grouped in the following sections: —

EUYUCCA. Filaments obtuse, papillose, free, or nearly so, from the segments of the perigone, spreading or recurved at maturity; anthers cordate-sagittate; pollen powdery; style stout, papillose, rarely expanded at the apex.

A. SARCOYUCCA. Panicle usually sessile. Fruit baccate, pendulous; exocarp thick and succulent; seeds thick; albumen ruminate. Stems generally arborescent.

B. CLISTOYUCCA. Panicle sessile or pedunculate. Fruit baccate, indehiscent, spreading or erect; exocarp becoming dry and spongy at maturity; seeds thick; albumen entire. Stems arborescent.

C. CHÆNOYUCCA. Panicles long-stalked. Fruit capsular, erect, septicidally dehiscent, ultimately splitting through the valves at the apex; seeds thin; albumen entire. Stems short or arborescent.

HESPEROYUCCA. Panicle long-stalked; filaments acute, glabrous, erect at maturity; anthers didymous, transverse, hirsute; style slender; stigma three-lobed, papillose. Fruit capsular, erect, three-valved, the valves entire; seeds thin; albumen straight. Stems subterranean.

Yucca, of which about eighteen species can be distinguished, is confined to the New World, where it ranges from Maryland, western Iowa, South Dakota, and southern California, to Lower California, Yucatan, and Central America, the region of its greatest development being in the territory adjacent to the boundary between the United States and Mexico. Twelve species[1] inhabit the United States, eight of them assuming the habit, and attaining the size of trees, while the others are stemless. At least one arborescent species[2] is endemic in northern Mexico, one[3] ranges from southern Mexico to Guatemala; the flora of Yucatan contains another arborescent Yucca,[4] and several still little known species have been found in Lower California.[5] The tertiary rocks of western Europe contain remains which indicate that Yucca is an ancient form, and that it was once more widely scattered over the earth's surface than it is at present.[6]

The saponaceous root-stocks of Yuccas are used by Mexicans and Indians as a substitute for soap.[7] The fibrous wood is occasionally sawed into lumber, and has been manufactured into paper-pulp. The fleshy fruits of several species, which contain a large amount of sugar, are edible, and in Mexico are frequently made into a fermented beverage, which is occasionally distilled.[8] The tough fibres of the leaves of the Bear Grass, *Yucca filamentosa*,[9] are used domestically in the United States in binding, and those of some of the Mexican species are made into ropes. The leaves of most of the species were woven into baskets by the Indians, who used them also in the manufacture of mats and whips;[10] and the tender ends of the growing stems are roasted and eaten in Mexico.[11] The young stems of

[1] By means of the artificial fecundation of different species performed in his garden at Marseilles several years ago, Monsieur Deleuil secured large quantities of seed, from which he has raised a number of hybrid Yuccas. (See Deleuil, *Rev. Hort.* 1880, 225. — André, *Rev. Hort.* 1883, 109.) One of these hybrids, produced by crossing *Yucca lævigata*, itself a hybrid of *Yucca aloifolia* and a form of *Yucca glauca*, with *Yucca glauca* is now cultivated in many gardens as *Yucca Carrierei* (André, *l. c.* 1895, 81, f. 21–23).

[2] *Yucca filifera*, Chabaud, *Rev. Hort.* 1876, 432, f. 97. — Carrière, *Rev. Hort.* 1879, 262; 1884, 53, f. 12, 13. — Sargent, *Garden and Forest*, i. 78, f. 13, 14. — *Gard. Chron.* ser. 3, iii. 743, f. 97, 100. — Fenzi, *Bull. Soc. Tosc. Ort.* ser. 2, iv. 278, t. 9. — Baker, *Bot. Mag.* cxvii. t. 7197. — Trelease, *Rep. Missouri Bot. Gard.* iv. 193.

Yucca baccata, β *australis*, Engelmann, *Trans. St. Louis Acad.* iii. 44 (in part) (1873). — Watson, *Proc. Am. Acad.* xiv. 252 (in part). — Baker, *Jour. Linn. Soc.* xviii. 229 (in part).

Yucca australis, Trelease, *l. c.* iii. 162 (in part), t. 3, 4 (1892); iv. 190 (in part).

Yucca filifera, the largest of the Yuccas now known, is a tree, often fifty feet in height, with a trunk frequently twenty feet tall and five feet in diameter, and many wide-spreading branches, and is distinguishable from all other species by its pendulous panicles of flowers and fruit, which are often six feet in length. It forms open forests of great extent on the plains which rise from the lower Rio Grande to the Sierra Madre, and ranges southward to San Luis Potosí. Introduced nearly forty years ago into the gardens of Europe, it is also occasionally cultivated in some of the Texan towns along the Rio Grande, and in northern Mexico, where it is often used in the neighborhood of Monterey and Saltillo to form stockades.

[3] *Yucca Guatemalensis*, Baker, *Refugium Bot.* v. t. 313 (1872); *Jour. Linn. Soc. l. c.* 222. — Engelmann, *l. c.* 38. — Watson, *l. c.* 251. — Hemsley, *Bot. Biol. Am. Cent.* iii. 371. — Trelease, *l. c.* 162; iv. 184, t. 1, 2, 19.

This arborescent much-branched species, which is little known in a wild state, is said to be one of the common Yuccas in the gardens of southern France and the Riviera, where it usually appears as *Yucca Draconis*, although it is not the Linnæan plant of that name. (See Baker, *Kew Bull. Misc. Information*, January, 1892, 7.)

[4] *Yucca Yucatana*, Engelmann, *l. c.* 37 (1873). — Watson, *l. c.* 251. — Baker, *Jour. Linn. Soc. l. c.* 222. — Hemsley, *l. c.* — Trelease, *l. c.* 45; *l. c.*

[5] Brandegee, *Proc. Cal. Acad.* ser. 2, ii. 208, t. 11 (*Pl. Baja Cal.*); iii. 175.

[6] Bureau, *Mém. Publiés par le Soc. Philomathique à l'Occasion du Centenaire de sa Fondation*, 255, t. 23 (*Études sur la Flore Fossile du Calcaire Grossier Parisien*).

[7] Loew, *Wheeler's Rep.* iii. 609. — Palmer, *Am. Nat.* xii. 646. — Abbott, *Proc. Am. Phil. Soc.* n. ser. xvi. 254 (*A Chemical Study of Yucca angustifolia*). — Newberry, *Popular Science Monthly*, xxxii. 42 (*Food and Fibre Plants of the North American Indians*).

[8] Havard, *Bull. Torrey Bot. Club*, xxiii. 37 (*Drink Plants of the North American Indians*).

[9] Linnæus, *Spec.* 319 (1753). — Walter, *Fl. Car.* 124. — *Bot. Mag.* xxiii. t. 900. — Redouté, *Liliacées*, v. t. 277, 278. — Elliott, *Sk.* i. 400. — Loiseleur, *Herb. Amat.* iv. t. 258. — Chapman, *Fl.* 485. — Engelmann, *l. c.* 51. — Watson & Coulter, *Gray's Man.* ed. 6, 524.

This stemless and very variable species inhabits sandy barren soil and abandoned fields in the neighborhood of the coast from southern Maryland southward to Florida and westward along the southern borders of the Gulf states to Louisiana. It is the best known of all the Yuccas in northern gardens, which it enlivens in midsummer with its great panicles of large ivory-white flowers.

The tough leaves of this species are twisted and used in the southern states for hanging hams and for other domestic purposes. Attempts have been made to utilize their fibre commercially; but, though it is exceedingly strong and cheaply produced, the shortness of Yucca-fibre lessens its value, and it has not yet been successfully introduced into commerce. (See Porcher, *Resources of Southern Fields and Forests*, 530. — C. R. Dodge, *U. S. Dept. Agric. Fibre Investigation Rep.* No. 5, 70 [*A Report on the Leaf Fibres of the United States*].)

[10] Havard, *Garden and Forest*, iii. 631.

[11] Bartlett, *Personal Narrative of Explorations and Incidents in*

some of the arborescent species, which are often beset with leaves from the surface of the ground upward, are employed to protect dwellings and gardens from the intrusion of cattle.

Yucca is rarely attacked by insects,[1] and is comparatively free from fungal diseases.[2]

Owing to their numerous clusters of beautiful large waxy white flowers and their habit, unfamiliar to northern eyes and the people of the Old World, Yuccas have become favorite garden plants, and many of the species may now be seen in the pleasure-grounds of the northern states, and of Europe, where they grow without protection in the countries bordering the Mediterranean.

Yuccas can be raised from seeds, which germinate readily and quickly, by cutting off the terminal or lateral crowns of leaves and placing them on the surface of the soil of propagating beds, where they will soon develop roots, or from pieces of the stolons.[3]

The generic name is derived from the Carib name of the root of the Cassava.[4]

Texas, New Mexico, California, Sonora, and Chihuahua, ii. 490. — *Rev. Hort.* 1886, 508.

[1] In the coast region of the south Atlantic states Yuccas, especially *Yucca aloifolia*, are frequently injured by the larvæ of *Megathymus Yuccæ*, Walker, which bore into the underground stems and, by weakening the trunk and inducing decay, frequently cause the prostration of the plant. The presence of the borer can be detected by its excrements at the base of the leaves and by chimney-like projections formed by the bases of the flower-stalk and of the tender partly devoured young leaves, through which they are expelled. (See Riley, *Trans. St. Louis Acad.* iii. 223 [*Notes on the Yucca Borer*] ; *8th Ann. Rep. Insects of Missouri*, 169.)

[2] The fungi which are known to attack the different species of Yucca belong almost exclusively to the Pyrenomycetes. The most widely diffused among them is probably *Kellermannia yuccægena*, Ellis & Everhart, which infests the leaves of *Yucca aloifolia*, *Yucca arborescens*, *Yucca glauca*, *Yucca filamentosa*, and probably occurs on other species also. It appears in the form of very numerous minute spots which have a black border and a paler-colored centre and hardly protrude above the surface of the leaf, and is one of the imperfect forms as yet unknown in a perfect condition. Apparently it attacks the living leaves, which it at first disfigures, and ultimately destroys, and in the case of cultivated Yuccas it might become a serious disease. A larger and more striking, although less widely distributed fungus, *Dothidea Pringlei*, Peck, attacks the leaves of *Yucca aloifolia* and *Yucca Schottii*, forming prominent hard black tubercles of considerable size. The other fungi which attack Yuccas are all small, the most characteristic being *Nectria depauperata*, Cooke, *Leptosphæria filamentosa*, Ellis & Everhart, *Phyllachora scapincola*, Saccardo, and *Anthostomella nigroannulata*, Saccardo, belonging to the Pyrenomycetes, and the imperfect *Cercospora Yuccæ*, Cooke, and *Septoria Yuccæ*, Saccardo.

[3] Baines, *The Garden*, xxxiii. 487.

[4] Parkinson, *Theatr.* 154, 1624.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Euyucca. Filaments clavate, papillose, free from the perigone, spreading or recurved at maturity; anthers cordate, emarginate, glabrous; pollen powdery; ovary sessile or stipitate; style 3-lobed, short or elongated.

Sarcoyucca. Panicle usually sessile. Fruit baccate, pendulous, the exocarp thick and succulent; seeds thick; albumen ruminate.

Panicle glabrous or puberulous.

Ovary stipitate. Leaves serrulate, slightly concave, smooth, dark green . . . . . 1. Y. ALOIFOLIA.

Leaves concave, blue-green, rough on the lower surface . . . . . 2. Y. TRECULEANA.

Leaves flat, smooth, dark green . . . . . 3. Y. MACROCARPA.

Leaves concave above the middle, smooth, light yellow-green . . . . . 4. Y. MOHAVENSIS.

Panicle coated with hoary tomentum.

Leaves concave, smooth, light yellow-green . . . . . 5. Y. SCHOTTII.

Clistoyucca. Panicle stalked or sessile, inclosed at first in a large egg-shaped bud formed by its closely imbricated bracts. Fruit baccate, erect or spreading, the exocarp becoming thin and dry at maturity; seeds thin; albumen entire.

Leaves concave above the middle, blue-green, sharply serrate . . . . . 6. Y. ARBORESCENS.

Leaves thin, flat or concave toward the apex, rough on the lower surface, dull or glaucous green, more or less plicately folded . . . . . 7. Y. GLORIOSA.

Chænoyucca. Panicle pedunculate. Fruit capsular, erect, septicidally and loculicidally dehiscent; seeds thin, albumen entire.

Leaves thin and flat, filamentose on the margins, smooth, pale yellow-green . . . . 8. Y. CONSTRICTA.

YUCCA ALOIFOLIA.

Spanish Bayonet.

OVARY stipitate. Leaves serrulate, slightly concave, smooth, dark green.

Yucca aloifolia, Linnæus, *Spec.* 319 (1753). — Miller, *Dict.* ed. 8, No. 2. — Walter, *Fl. Car.* 124. — Aiton, *Hort. Kew.* i. 465. — Salisbury, *Prodr.* 246. — Willdenow, *Spec.* ii. pt. i. 184. — De Candolle, *Pl. Hist. Succ.* i. t. 21. — Michaux, *Fl. Bor.-Am.* i. 196. — Persoon, *Syn.* i. 378. — Desfontaines, *Hist. Arb.* i. 18. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 201. — Pursh, *Fl. Am. Sept.* i. 228. — Redouté, *Liliacées*, vii. t. 401, 402. — *Bot. Mag.* xli. t. 1700. — Tussac, *Fl. Antill.* ii. 108, t. 29. — Nuttall, *Gen.* i. 218. — Haworth, *Suppl. Pl. Succ.* 32. — Sprengel, *Syst.* ii. 41. — Roemer & Schultes, *Syst.* vii. pt. i. 716; pt. ii. 1715. — Paxton, *Mag. Bot.* iii. 25, t. — Dietrich, *Syn.* ii. 1093. — Kunth, *Enum.* iv. 270. — Spach, *Hist. Vég.* xii. 283. — Regel, *Gartenflora*, viii. 34. — Chapman, *Fl.* 485. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 94. — Engelmann, *Trans. St. Louis Acad.* iii. 34. — Hemsley, *The Garden*, viii. 131, f.; *Bot. Biol. Am. Cent.* iii. 369. — Baker, *Gard. Chron.* 1870, 828, f. 154; *Jour. Linn. Soc.* xviii. 221; *Kew Bull. Misc. Information*, January, 1892, 7. — Watson, *Proc. Am. Acad.* xiv. 251. — Trelease, *Rep. Missouri Bot. Gard.* iii. 162; iv. 182, t. 18, f. 1–3. — Webber, *Rep. Missouri Bot. Gard.* vi. 93, t. 45, 46, 47, f. 1–4.

Yucca serrulata, Haworth, *Syn. Pl. Succ.* 70 (1812). — Roemer & Schultes, *Syst.* vii. pt. i. 716. — Kunth, *Enum.* iv. 270. — Regel, *Gartenflora*, viii. 35.

Yucca crenulata, Haworth, *Suppl. Pl. Succ.* 33 (1819). — Roemer & Schultes, *Syst.* vii. pt. i. 717. — Kunth, *Enum.* iv. 271.

Yucca arcuata, Haworth, *Suppl. Pl. Succ.* 33 (1819). — Roemer & Schultes, *Syst.* vii. pt. i. 717. — Kunth, *Enum.* iv. 271.

Yucca tenuifolia, Haworth, *Suppl. Pl. Succ.* 34 (1819). — Roemer & Schultes, *Syst.* vii. pt. i. 717. — Kunth, *Enum.* iv. 271. — Regel, *Gartenflora*, viii. 35.

Yucca serrulata, α vera, Regel, *Gartenflora*, viii. 35 (1859).

Yucca serrulata, β robusta, Regel, *Gartenflora*, viii. 35 (1859).

A tree, occasionally twenty-five feet in height, although usually much smaller, with a single erect or more or less inclining trunk, which is slightly swollen at the base and is simple or produces two or three short erect branches, rarely more than six inches in diameter, or with several spreading stems, and a long stout caudex. The leaves, which clothe the stem to the ground while the plant is young, are erect and rather remote except at the apex, where they are closely imbricated into a dense cluster; and in old age only the base of the trunk is covered with thick rough dark brown bark, while the scars left by the falling leaves mark the remaining portion where it is not hidden by the withered decumbent leaves which press closely against it and usually do not fall until many years after their death. The leaves are linear-lanceolate, ridged, and conspicuously narrowed above the broad thin light green base which is from an inch and a half to two inches broad and marked with a red transverse band; they are widest above the middle, slightly concave on the upper surface, finely and irregularly serrate with minute dark cartilaginous obtuse teeth, mucronate with a stout stiff dark red-brown spine-like tip one third of an inch in length, smooth dark rich green, from eighteen to thirty-two inches, but usually about twenty-four inches long, and from one and a quarter to two and a half inches wide. The flowers appear from June until August in nearly sessile glabrous or slightly pubescent panicles from eighteen to twenty-four inches in length; their bracts are ovate or oblong, acute, mucronate, thick, white, leathery, and glabrous, and wither without falling, the largest being four or five inches long and often an inch wide, while those at the base of the pedicels toward the ends of the branches of the panicle are not more than half an inch long and an eighth of an inch wide; they are borne on stout pedicels from one to two inches long, and vary from an inch to an inch and a half in length, and when expanded during the night are from three to four inches across. The base of the perigone is greenish and sometimes flushed with purple; its segments are ovate, and thick and tumid toward the base; those of the outer

rank are rounded and often marked with dark purple at the apex, and the inner are acuminate and short-pointed. The stamens are usually about as long as or sometimes a little longer than the light green ovary, which is raised on a short stout stipe,[1] and is crowned by the sessile stigmatic lobes. The fruit, which is often produced abundantly without the aid of the Yucca Moth, ripens from August to October; it is elongated, elliptical, hexagonal by the spreading of the septal glands, the sides alternate with the carpels being sharply depressed, rounded at the base, and gradually narrowed at the apex, which is tipped with the stigmatic lobes; it has a thick outer coat and a thin firm white membranaceous endocarp, and is from three to four inches long and from an inch and a quarter to an inch and a half thick; when fully grown it is light green and rather lustrous, and in ripening turns a deep dark rich purple throughout, the outer and inner coats of the pericarp forming a thick indehiscent succulent homogeneous tender mass of bitter-sweet juicy flesh, which finally turns black and dries up on the panicle. The seed is from one quarter to one third of an inch broad and about one sixteenth of an inch thick, with thin narrow wing-like borders to the rim.[2]

Yucca aloifolia grows only in the neighborhood of the coast and on its islands, and is distributed from North Carolina southward to southern Florida, and along the Gulf to eastern Louisiana. In the Atlantic states it usually grows close to the sea, generally on the sand-dunes of beaches and the sandy borders of brackish swamps; in Florida it is abundant on the sand-dunes of the coast, and occasionally occurs on rich hummocks, whither it may have been carried by the Indians, who used the fibres of its leaves; and west of the Appalachicola River, where it attains its largest size, *Yucca aloifolia* is common on the islands and beaches of the coast, and extends inland for thirty or forty miles, growing with stunted Oaks in the dry sandy soil of the Pine forest.

The wood of *Yucca aloifolia* has not been examined.

The succulent fruits, which have a sweet and rather pleasant flavor, are eagerly devoured by birds, and are occasionally eaten by whites and negroes in the southern states, where they are often called bananas.

Yucca aloifolia was one of the first Yuccas known to Europeans, and one form of it appears to have been described by Caspar Bauhin in 1623.[3] After the settlement of the southern coast of North America by Europeans it must soon have been carried to the West Indies, as it was thoroughly naturalized in Jamaica and other islands more than a century ago, and to the Mexican Gulf coast, where it is also naturalized and is believed by many authors to be indigenous.

Yucca aloifolia is now a familiar object in the gardens of all temperate countries, and accidental forms with leaves variously striped with green, white, and yellow are common in cultivation.[4]

[1] Trelease, *Rep. Missouri Bot. Gard.* iv. 184.

[2] A form of this plant which is said to bear longer, less crowded, soft, and somewhat curved and pendulous leaves, and is known only in European gardens, is: —

Yucca aloifolia, var. β *Draconis*, Engelmann, *Trans. St. Louis Acad.* iii. 35 (1873).

Yucca Draconis, Linnæus, *Spec.* 319 (1753). — Miller, *Dict.* ed. 8, No. 3. — Aiton, *Hort. Kew.* i. 465. — Gærtner, *Fruct.* ii. 34, t. 85, f. 9. — Persoon, *Syn.* i. 378. — Desfontaines, *Hist. Arb.* i. 18. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 201. — Elliott, *Sk.* i. 401. — Haworth, *Suppl. Pl. Succ.* 32. — Sprengel, *Syst.* ii. 41. — Roemer & Schultes, *Syst.* vii. pt. i. 716. — *Bot. Reg.* xxii. t. 1894. — Dietrich, *Syn.* ii. 1093. — Kunth, *Enum.* iv. 270. — Spach, *Hist. Vég.* xii. 284. — Baker, *Gard. Chron.* 1870, 828.

Yucca Haruckeriana, Crantz, *Duab. Drac. Arbor.* 29 (1768).

Another form known only in gardens, with soft although not pendulous leaves, with green and less ridged points, is: —

Var. γ *conspicua*, Engelmann, *l. c.* (1873).

Yucca conspicua, Haworth, *l. c.* 32 (1819). — Sprengel, *l. c.* — Roemer & Schultes, *l. c.* 715. — Kunth, *l. c.*

[3] *Draconi arbori affinis Americana*, *Pinax*, 506.

Aloe Americana juccæ foliis arborescens, Kigglaer, *Cat. Hort. Beaum.* 5. — K. Commelin, *Præl. Bot.* 64, t. 14.

Aloë Yuccæ foliis, caulescens, Hermann, *Parad. Bat. Prodr.* 306. — Plukenet, *Phyt.* t. 256, f. 4; *Alm. Bot.* 19.

Aloë; Americana; folio Yuccæ; arborescens, Boerhaave, *Ind. Alt. Hort. Lugd. Bat.* pt. ii. 131.

Yucca arborescens, foliis rigidioribus rectis serratis, Dillenius, *Hort. Elth.* 435, t. 323, f. 416.

Yucca Draconis folio serrato reflexo, Dillenius, *l. c.* 437, t. 324, f. 417 (excl. syn. Commelin).

Yucca foliorum margine crenulato, Linnæus, *Hort. Cliff.* 130 (excl. syn. Sloane, ? J. Bauhin and ? Clusius); *Hort. Ups.* 88.

Yucca foliis crenulatis, Linnæus, *Virid. Cliff.* 29.

Cordyline foliis pungentibus crenulatis, Royen, *Fl. Leyd. Prodr.* 221.

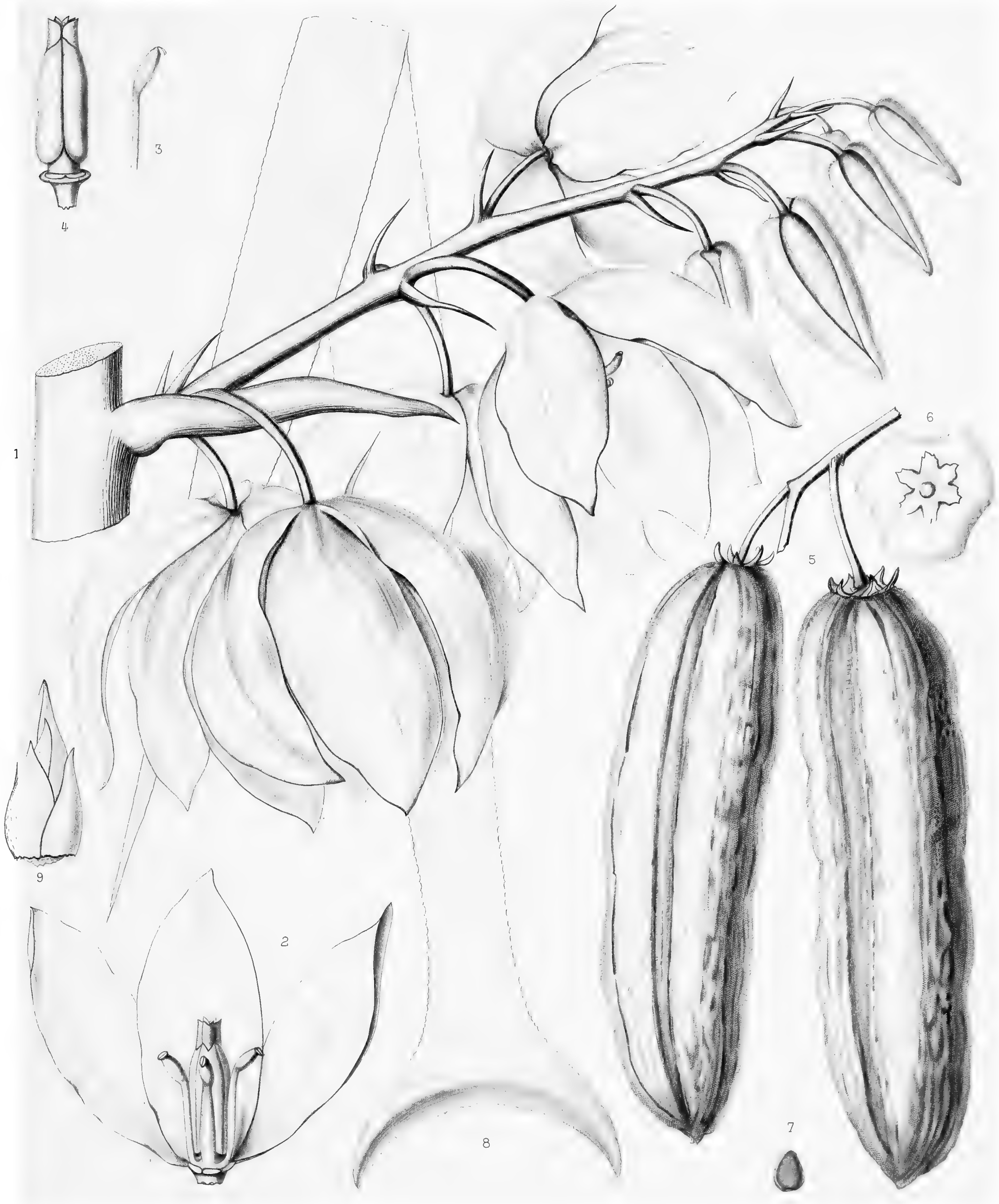
[4] *Yucca tricolor*, *Yucca lineata lutea*, *Yucca quadricolor*, Hort. — *Yucca serrata*, γ *argenteo-marginata*, and δ *roseo-marginata*, Regel, *Gartenflora*, viii. 35 (1859).

In gardens *Yucca aloifolia* sometimes appears as *Yucca purpurea* and as *Yucca Atkinsi*.

EXPLANATION OF THE PLATE.

PLATE CCCCXCVII. YUCCA ALOIFOLIA.

1. A branch of a flowering panicle, natural size.
2. Vertical section of a flower, natural size.
3. A stamen, natural size.
4. A pistil, natural size.
5. Portion of a fruit-cluster, natural size.
6. A fruit, basal view, natural size.
7. A seed, natural size.
8. A leaf, natural size.
9. A leaf-bud, natural size.



C.E. Faxon del. Lövendal sc.

YUCCA ALOIFOLIA, L

A. Riocreux direx.t Imp. J. Taneur, Paris.

YUCCA TRECULEANA.

Spanish Bayonet. Spanish Dagger.

LEAVES concave, blue-green, rough on the lower surface.

Yucca Treculeana, Carrière, *Rev. Hort.* 1858, 580; 1869, 406, f. 82. — Baker, *Gard. Chron.* 1870, 828; *Jour. Linn. Soc.* xviii. 226. — Engelmann, *Trans. St. Louis Acad.* iii. 41, 210, 212. — Hemsley, *The Garden*, viii. 131, f.; xii. 328, t.; *Bot. Biol. Am. Cent.* iii. 371. — André, *Rev. Hort.* 1887, 369, f. 74. — Trelease, *Rep. Missouri Bot. Gard.* iii. 162, t. 47; iv. 185, t. 18, f. 4, 5. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 436 (*Man. Pl. W. Texas*).

Yucca aspera, Regel, *Ind. Sem. Hort. Petrop.* 1858, 24; *Gartenflora*, viii. 35.

Yucca canaliculata, Hooker, *Bot. Mag.* lxxxvi. t. 5201 (1860). — Baker, *Gard. Chron.* 1870, 1217. — Engelmann, *Trans. St. Louis Acad.* iii. 43. — Watson, *Proc. Am. Acad.* xiv. 252. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 218.

Yucca longifolia, Buckley, *Proc. Phil. Acad.* 1862, 8.

A tree, occasionally twenty-five or thirty feet in height, with a trunk sometimes two feet in diameter, and numerous stout wide-spreading branches, but usually smaller, and often forming broad low thickets of simple stems four or five feet high. The bark of old trunks is from one fourth to one half of an inch in thickness, dark red-brown, and broken into thick oblong plates covered with small irregular rather closely appressed scales. The leaves are lanceolate, slightly or not at all contracted above the broad dark red lustrous base, concave, and tipped with short stout dark red-brown spines, their margins being at first dark brown, with a pale cartilaginous edge roughened by minute deciduous teeth, and ultimately separating into slender dark fibres; they vary from two and a half to four feet in length, and from two to three and a quarter inches in width, and are stiff and rigid, dark blue-green, rough on the lower surface and nearly smooth on the upper, and do not fall for many years, the dead leaves hanging closely pressed against the trunk below the terminal crown of closely imbricated upright living leaves. The flowers appear in March and April, and are borne on slender pedicels from half an inch to an inch and a half in length, in a dense many-flowered much-branched glabrous or puberulous panicle from two to four feet long, and raised on a short stalk from one to two inches in diameter; the bracts are ovate-oblong, gradually or abruptly contracted toward the apex, which is tipped with a long rigid brown spine, concave, white, and leathery, five or six inches long, from one to three inches wide, and often green above the middle, especially those at the very base of the inflorescence; on its ultimate divisions they are thinner, and flushed with purple above the middle, ovate-lanceolate, and about an inch long and a quarter of an inch wide, with stout soft points. The perigone when fully expanded varies from two to four inches across, and is from one to two inches in length; its narrow elongated segments are ovate-lanceolate or rarely ovate, about a quarter of an inch wide, thin and delicate, acute, and furnished at the apex with conspicuous tufts of short pale hairs. The filaments are slightly papillose, and about as long as the prismatic ovary, which is gradually narrowed above, and crowned by the deeply divided stigmatic lobes. The fruit, which ripens in the summer, is indehiscent, cylindrical, or obscurely hexagonal, somewhat sulcate or three-lobed, and abruptly narrowed at the apex into a short stout point; it is from three to four inches long, and about an inch thick, and is borne on a stout recurved stalk from an inch and a half to two inches in length; the outer coat is dark reddish brown, thin, and succulent, with a sweet, although slightly bitter, rather agreeable flavor, and easily separates from the thin light brown membranaceous inner coat. The seeds are about an eighth of an inch broad, and nearly a sixteenth of an inch thick, with slightly winged rims.[1]

[1] No observations have been made on the pollination of *Yucca Treculeana*. Cultivated plants are habitually sterile; and Professor Riley believed that the flowers were fertilized by a distinct and undescribed species of Pronuba. (See *Rep. Missouri Bot. Gard.* iii. 122; *Proc. Biol. Soc. Washington*, vii. 96; *Insect Life*, iv. 371.)

Yucca Treculeana is distributed from the shores of Matagorda Bay southward through western Texas to the valleys of the Sierra Madre of Nuevo Leon, and westward up the valley of the Rio Grande to the high plateau at the eastern base of the mountain ranges of western Texas. Just within the coast dunes at the mouth of the Rio Grande in Texas *Yucca Treculeana* forms open stunted forests, and farther inland, where it is one of the common chapparal plants, it spreads into great impenetrable thickets. On the margins of the high plains and valleys, where they rise to meet the foothills of the Sierra Madre, *Yucca Treculeana* is the most conspicuous feature of the vegetation,[1] forming open forests, and growing to a large size; in western Texas it is less abundant and smaller.

The wood of *Yucca Treculeana* is light brown, fibrous, spongy, heavy, and difficult to cut and work. The specific gravity of the absolutely dry wood is 0.6677, a cubic foot weighing 41.61 pounds.

The fruit is cooked and eaten by the Mexicans of the valley of the Rio Grande, and the root-stock is used as a substitute for soap.

Described from a plant cultivated in France, where it was probably first introduced by the French naturalist[2] whose service to botany its specific name commemorates, *Yucca Treculeana* has long ornamented the gardens of southern Europe, growing to a large size, and flowering profusely,[3] as it does in the gardens of Austin and other Texas cities, which it often enlivens in early spring with enormous abundant and splendid clusters of brilliant flowers.[4]

[1] C. G. Pringle, *Garden and Forest*, iii. 338.

[2] Auguste Adolph Lucien Trécul was born in Mondoubleau, near Vendôme, in France, on the 18th of January, 1818, where his father was a baker, and was educated in the primary school of his native place and in the college at Vendôme. On graduating from college he went to Paris to study pharmacy, and in 1841 was admitted as an assistant in the Paris hospitals, and began the study of natural history. A paper published in 1843 in the *Annales des Sciences Naturelles* on the Fruits of Prismatocarpus and on that of the Crucifers attracted the attention of the authorities of the Museum, who engaged him temporarily to assist in the arrangement of the herbarium. At this time Trécul prepared a monograph of the Artocarpaceæ, published in the eighth volume of the third series of the Annales, and continued his studies upon the organs of plants, to which most of his attention as a botanist has been devoted. In 1814 he was sent by the Museum to North America to collect plants and animals, being also commissioned by the Minister of Agriculture and Commerce to study the esculent plants used by the Indians of the western plains. Arriving in North America in 1848, he traveled through the region between the Mississippi River and the Rocky Mountains for nearly three years, and returned to France in the autumn of 1850. His collections made during the first year of his stay in America were lost in the wreck of the ship to which they had been intrusted; but those made in Texas and northern Mexico, where he passed the winter of 1849, reached France in good condition, and included living plants of *Ungnadia speciosa*, *Yucca Treculeana*, *Sophora secundiflora*, *Guaiacum angustifolium*, *Rhus virens*, and several species of Cactus. Since 1850 Trécul has devoted himself to morphology and physiology, and has published many papers on these subjects in the *Comptes Rendus de l'Academie des Sciences*, the *Journal de Pharmacie*, *Annales des Sciences Naturelles*, *Revue Horticole*, etc. In 1851 he delivered a course of lectures on botany before the Institut National Agronomique at Versailles; but since his return from America has occupied no official position.

[3] Naudin, *Manuel de l'Acclimateur*, 558. — Baker, *Kew Bull. Miscellaneous Information*, January, 1892, 8.

In European gardens *Yucca Treculeana* is sometimes cultivated under the names of *Yucca agavoides*, *Yucca concava*, *Yucca cornuta*, *Yucca revoluta*, and *Yucca undulata*. (See Carrière, *Rev. Hort.* 1858, 580. — Baker, *Jour. Linn. Soc.* xviii. 226.)

[4] Sargent, *Garden and Forest*, i. 54, f. 10.

EXPLANATION OF THE PLATE.

Plate CCCCXCVIII. Yucca Treculeana.

1. Portion of a branch of a flowering panicle, natural size.
2. Diagram of a flower.
3. Vertical section of a flower, natural size.
4. A pistil, natural size.
5. Portion of a branch of a fruiting panicle, natural size.
6. Vertical section of a portion of a fruit, natural size.
7. A seed divided transversely, enlarged.
8. Vertical section of a seed, enlarged.
9. An embryo, enlarged.
10. The base of a leaf, natural size.

C.E. Faxon del. Himely sc.

YUCCA TRECULEANA, Carr.

A. Riocreux direx.t Imp. J. Taneur, Paris.

YUCCA MACROCARPA.

Spanish Dagger.

LEAVES flat, dark green. Fruit long-beaked.

Yucca macrocarpa, Coville, *Contrib. U. S. Nat. Herb.* iv. 202 (*Bot. Death Valley Exped.*) (1893). — Sargent, *Garden and Forest*, ix. 104.

Yucca baccata, var. macrocarpa, Torrey, *Bot. Mex. Bound. Surv.* 222 (1858).

Yucca baccata, β australis, Engelmann, *Trans. St. Louis Acad.* iii. 44 (in part) (1873). — Watson, *Proc. Am. Acad.* xiv. 252 (in part). — Baker, *Jour. Linn. Soc.* xviii. 229 (in part).

Yucca baccata, Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 219 (in part) (not Torrey) (1884). — Hemsley, *Bot. Biol. Am. Cent.* iii. 370 (in part).

Yucca filifera, Trelease, *Rep. Missouri Bot. Gard.* iii. 162, (in part) (not Chabaud) (1892).

Yucca australis, Trelease, *Rep. Missouri Bot. Gard.* iv. 190, t. 4, 5 (excl. hab. Parras) (1893). — Coulter, *Contrib. U. S. Nat. Herb.* ii. 436 (*Man. Pl. W. Texas*).

A tree, often forty feet in height, with a trunk sometimes two feet in diameter above the broad abruptly enlarged base, from which hard tough roots a third of an inch in thickness and covered with bright red-brown lustrous bark descend deep into the soil, and simple, or divided into several short branches; frequently smaller, and until ten or fifteen years old clothed from the ground with erect living leaves. Near the base the stems of old trees are covered with dark reddish brown bark from a third to a half of an inch in thickness and broken on the surface into small thin loose scales, and above are protected by a thick thatch of the pendent dry leaves of many seasons. The leaves are lanceolate, rigid, and from two and a half to four feet in length; they are abruptly contracted above the conspicuously thickened dark red and lustrous base, which is six or seven inches broad, and then gradually widen to above the middle, where they are from two and a half to three inches in breadth; they are flat on the upper surface, thickened and rounded on the lower toward the base, tipped with short stout dark spines, smooth, and clear dark green, their margins, which at first are brown and entire, breaking later into numerous stout gray or brown fibres, short and spreading near the apex of the leaf and long and more remote toward the base, where they form a thick cobweb-like mass between the leaves. The flowers, which in Texas appear in April, hang on thin drooping pedicels from three quarters of an inch to nearly three inches long, forming dense many-flowered glabrous panicles from three to four feet in length, with elongated pendulous branches and short peduncles; the bracts are ovate, acute or acuminate, mucronate at the apex, white, thick and leathery; often from ten to fourteen inches long and from three to four inches broad at the base of the panicle, they decrease in size upward, those at the base of its branches being from four to six inches long and about an inch wide, and those at the base of the pedicels, which do not fall until after the flowers, from an inch to an inch and a half long, a quarter of an inch wide, and membranaceous. The perigone is about two and a half inches in length, with obovate thin concave acute white waxy segments, narrowed at both ends and united at the base into a short tube, those of the outer rank being not more than half as wide as those of the inner rank and about two thirds as long. The stamens are much shorter than the ovary, with slender filaments pilose above the middle with short rigid hairs, and abruptly dilated and clavate at the apex. The ovary is sessile, conspicuously ridged, light yellow, marked with large pale raised lenticels, and gradually narrowed above into an elongated slender style deeply three-lobed at the apex. The fruit, which ripens in early summer, is indehiscent, slightly or not at all angled, abruptly contracted at the apex into a longer or shorter slender hooked beak, from three to four inches long and from an inch to an inch and a half thick, light orange-colored and lustrous

when it first ripens, and ultimately nearly black, with a thick succulent, although not juicy, bitter sweet and luscious outer coat and a thin light brown membranaceous inner coat. The seed is a quarter of an inch in length and about an eighth of an inch in thickness, with narrow or nearly obsolete margins to the rim.[1]

Yucca macrocarpa, which is the largest of the Yuccas that inhabit the United States, is common on the high desert plateau of southwestern Texas, where it is the most conspicuous feature of the vegetation, growing with Agaves, Nolinas, Cacti, and smaller Yuccas, in an open forest, and attaining its greatest size on the wide slopes leading up to the base of the mountains; it ranges westward into New Mexico and southward over the highlands of northern Mexico.[2]

The wood of *Yucca macrocarpa* has not been examined.

When slightly dried over a fire the green leaves of this plant become supple and can easily be slit into narrow shreds, which are used as withes, or substitutes for ropes in binding sheaves of grain, bundles of hay, and the loads of pack-saddles. Mexicans and Indians also obtain from the green leaves a strong smooth white fibre about three feet in length, by scraping them with a knife, leaving the shreds to dry for a short time upon the ground, washing them to remove the pith, and then combing the fibres or pulling them apart by hand.[3]

In the United States *Yucca macrocarpa* was first noticed in September, 1852, in southwestern Texas by Dr. J. M. Bigelow,[4] one of the botanists of the Mexican Boundary Survey.

The arid and inhospitable region which is the home of this tree is made beautiful in early spring by its broad panicles rising above the dense clusters of long dark green sword-shaped leaves with their drooping branches and large closely crowded flowers, and gleaming in the sunlight like countless spray-covered fountains.[5]

[1] No observations on the pollination of this species have been made. It blooms with or a little later than *Yucca Treculeana*, and a month earlier than *Yucca constricta*, with which species it is associated in western Texas, and the fruit shows the work of the larvæ of a Pronuba (Trelease, *Rep. Missouri Bot. Gard.* iv. 192).

[2] It is probably *Yucca macrocarpa* which attracts the attention of travelers on the Mexican Central Railway in Chihuahua. It was collected by Pringle on limestone hills in the Carneros Pass, Chihuahua, in 1889 and 1891 (Nos. 2841, 3912), and is perhaps the No. 1571 of Coulter's Mexican collection in Herb. Gray.

[3] Havard, *Proc. U. S. Nat. Mus.* viii. 516 (*Yucca baccata*).

[4] See i. 88.

[5] *Garden and Forest*, viii. 301, f. 42.

EXPLANATION OF THE PLATE.

PLATE CCCCXCIX. YUCCA MACROCARPA.

1. Portion of a branch of a flowering panicle, natural size.
2. A fruit, natural size.
3. A seed, natural size.
4. The base of a leaf, natural size.
5. The point of a leaf, natural size.
6. A seedling, natural size.

C.E. Faxon del. Himely sc.

YUCCA MACROCARPA, Cov.

A. Riocreux direx.t. Imp. J. Taneur, Paris.

YUCCA MOHAVENSIS.

Spanish Dagger.

LEAVES concave, smooth, light yellow-green.

Yucca Mohavensis, Sargent, *Garden and Forest*, ix. 104 (1896).

Yucca filamentosa ? Wood, *Proc. Phil. Acad.* 1868, 167 (not Linnæus).

Yucca baccata, Engelmann, *Trans. St. Louis Acad.* iii. 44 (in part) (1873). — Watson, *Proc. Am. Acad.* xiv. 252 (in part). — Baker, *Jour. Linn. Soc.* xviii. 229 (in part). — Brewer & Watson, *Bot. Cal.* ii. 164 (in part). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 219 (in part). — S. B. Parish, *Garden and Forest*, iv. 136; *Zoë*, iv. 348. — Trelease, *Rep. Missouri Bot. Gard.* iii. 162 (in part), t. 2; iv. 185 (in part).

Yucca macrocarpa, Merriam, *North American Fauna*, No. 7, 358, t. 14 (*Death Valley Exped.* ii.) (not *Yucca baccata*, var. *macrocarpa*, Torrey, nor *Yucca macrocarpa*, Engelmann) (1893). — Coville, *Contrib. U. S. Nat. Herb.* iv. 202 (*Bot. Death Valley Exped.*) (in part).

A tree, rarely exceeding fifteen feet in height, with a trunk which is usually simple, or occasionally furnished with short spreading branches, and is six or eight inches in diameter, covered toward the base with dark brown bark, and generally surrounded by a cluster of shorter more or less spreading stems often clothed to the ground with living leaves, and thus forming small thickets, and thick branching root-stocks. The leaves are lanceolate, abruptly contracted above the thickened dark red and lustrous base, which is from three to three and a half inches wide, gradually narrowed upward to above the middle, where they are often an inch and a half in width, thin and concave except toward the slightly thickened base of the blade, the two edges being almost closed together near the apex, which terminates in a stout dark rigid sharp-pointed tip; they are light yellow-green, smooth on both surfaces, and from eighteen to twenty-four inches in length, with entire margins which at first are bright red-brown but soon begin to separate into numerous long pale smooth thick filaments. The flowers appear from March on the deserts of the interior to the beginning of May on the coast; they are produced in densely flowered panicles which are glabrous or roughened with reddish brown scurfy pubescence, usually more or less flushed with purple, sessile or short-stemmed, from twelve to eighteen inches in length, and furnished near the base of the rachis and below the lowest branch with a pair of flowers, and are borne on slender nearly erect ultimately drooping pedicels from an inch to an inch and a half in length, and occasionally forked near the middle and two-flowered; the bracts at the base of the panicle are linear-lanceolate, sharp-pointed, from eight to ten inches in length, white below and green and leaf-like above the middle; those at the base of the short and rather slender branches of the panicle are from five to seven inches in length, creamy white on the inner surface, and more or less deeply tinged with purple on the outer; and those at the base of the pedicels near the apex of the panicle are often not more than half an inch long and an eighth of an inch wide. The flowers vary much in size, even on neighboring plants, on some the perigone being two and a half inches and on others not more than an inch in length; the segments are united at the base into a short tube, and are thickened and hood-shaped at the apex, which is furnished with a tuft of pale hairs; those of the outer rank, which are often deeply flushed with purple, are much thickened externally toward the base and keeled along the back with a stout keel extending slightly above the rounded apex, narrowed below, concave and slightly grooved on the inner face and but little longer than the less prominently ribbed usually wider and thinner segments of the inner rank. The stamens rise nearly to the base of the stigma, with filaments which are rounded or flattened on the back and more or less pilose from the base upward. The ovary is sessile, slightly three-lobed, pale green, gradually narrowed above into a short stout three-lobed style penetrated by a wide stigmatic tube, the

lobes deeply emarginate at the apex. The fruit, which is rather sparingly produced, ripens in August and September, and is pendulous, indehiscent, from three to four inches long, about an inch and a half thick, usually much constricted near the middle and abruptly contracted at the apex into a short stout point, and in ripening turns from green to a tawny yellow color, and then passes through shades of brownish purple, finally becoming dark dull brown or nearly black; it has sweet succulent flesh, often half an inch in thickness, and a thin light brown inner coat. The seeds are a third of an inch wide, rather less than an eighth of an inch thick, and furnished with narrow borders to the rim.

An inhabitant of the desert, where it is scattered either singly or in small groups, *Yucca Mohavensis* grows on mountain slopes, which it sometimes ascends to elevations of about four thousand feet above the level of the sea, and on the sides of the depressions made by sudden torrents, and is distributed from southern Nevada and northeastern Arizona across the Mohave Desert, where it attains its largest size, over the western rim of the Colorado Desert and from the southern base of the San Bernardino Mountains to the California coast, along which it extends from northern Lower California[1] to the neighborhood of Monterey, being less abundant here than in the interior, and often remaining stemless in the California coast region.

The wood of a plant from San Diego, California, is soft, spongy, light brown, and difficult to work. The specific gravity of the absolutely dry wood is 0.2724, a cubic foot weighing 16.98 pounds.

From the fibres of the leaves gayly decorated blankets are woven by the Indians of southern California, who also make them into cords.[2]

First noticed in California in 1852 by Dr. C. C. Parry,[3] one of the botanists of the expedition sent to determine the boundary between the United States and Mexico, *Yucca Mohavensis* was long confounded with the stemless *Yucca baccata*[4] of the Colorado plateau and with *Yucca macrocarpa* of western Texas and Chihuahua.

[1] Brandegee, *Proc. Cal. Acad.* ser. 2, ii. 208 (*Pl. Baja Cal.*).

[2] Palmer, *Am. Nat.* xii. 646.

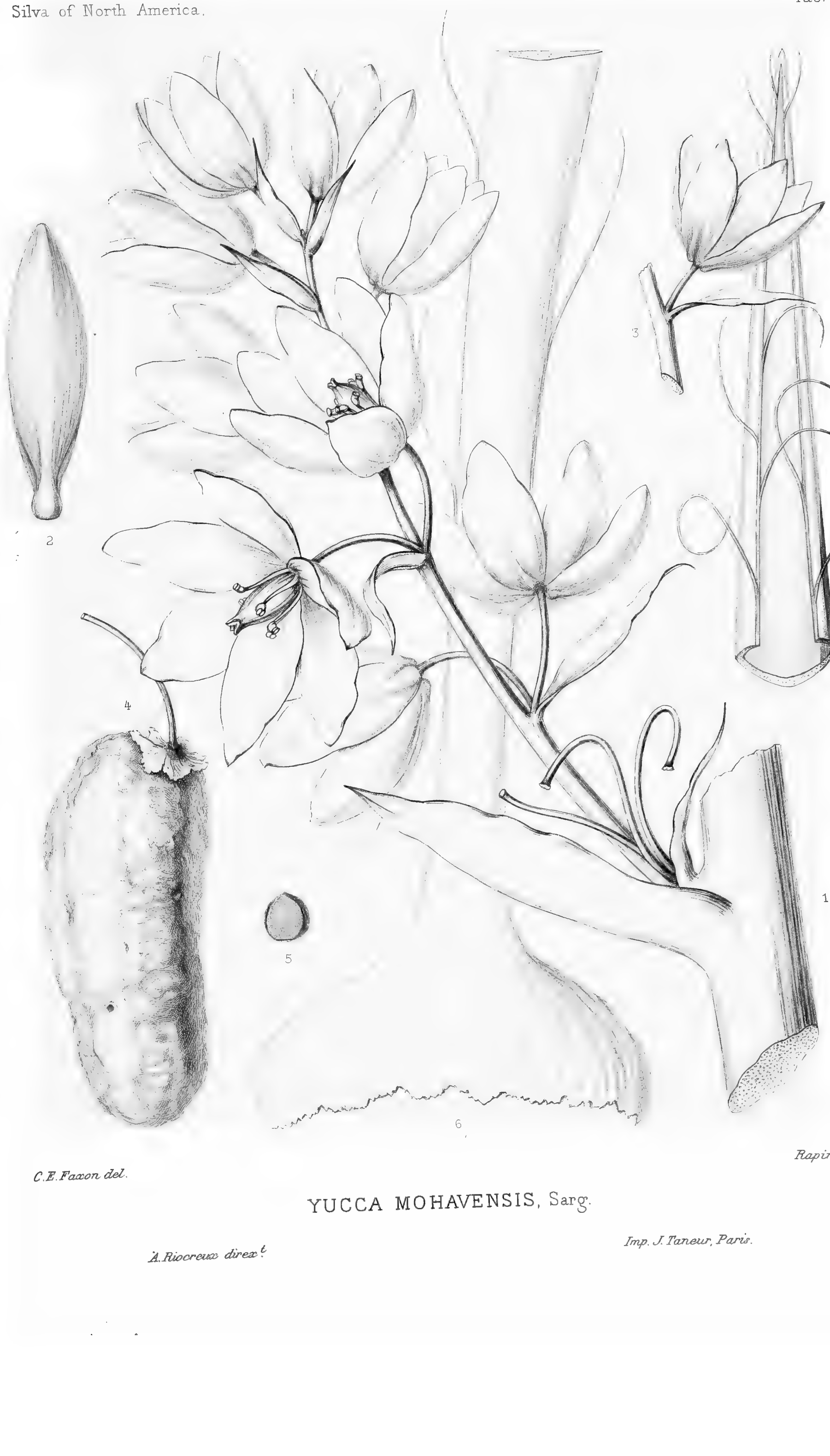
[3] See vii. 130.

[4] *Yucca baccata* (Torrey, *Bot. Mex. Bound. Surv.* 221 (in part) [1859]) is a plant with a subterranean stem, or a stem some eight or ten feet long lying prostrate on the surface of the ground, tufts of glaucous concave leaves much roughened on the back and from three to four feet in length, larger flowers than those of any other species of Yucca now known, the perigone often exceeding four inches in length, and large indehiscent succulent fruits narrowed at the apex into short beaks. *Yucca baccata* is an inhabitant of the Colorado plateau, where it is distributed from southwestern Colorado to northern New Mexico and northern Arizona, being abundant on the high Pine-covered plains south of the cañon of the Colorado River, but apparently not extending south of the rim of the plateau or descending into the desert.

EXPLANATION OF THE PLATE.

PLATE D. YUCCA MOHAVENSIS.

1. A branch of a flowering panicle, natural size.
2. Outer segment of the perigone, rear view, enlarged.
3. A flower, natural size.
4. A fruit, natural size.
5. A seed, natural size.
6. The base of a leaf, natural size.
7. The point of a leaf, natural size.



C.E. Faxon del. *Rapine sc.*

YUCCA MOHAVENSIS, Sarg.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

YUCCA SCHOTTII.

Spanish Dagger.

PANICLE coated with hoary tomentum. Leaves concave above the middle, smooth, light yellow-green.

Yucca Schottii, Engelmann, *Trans. St. Louis Acad.* iii. 46 (1873). — Watson, *Proc. Am. Acad.* xiv. 252. — Baker, *Jour. Linn. Soc.* xviii. 228. — Hemsley, *Bot. Biol. Am. Cent.* iii. 371. — Trelease, *Rep. Missouri Bot. Gard.* iii. 162; iv. 185, t. 3.

Yucca puberula, Torrey, *Bot. Mex. Bound. Surv.* 221 (not Haworth) (1859).

Yucca baccata, Engelmann, *Rothrock Wheeler's Rep.* vi. 270 (in part) (1878).

Yucca macrocarpa, Engelmann, *Bot. Gazette*, vi. 224 (not *Yucca baccata* var. *macrocarpa*, Torrey) (1881). — Baker, *Kew Bull. Misc. Information*, January, 1892, 8. — Trelease, *Rep. Missouri Bot. Gard.* iii. 162, ? t. 46. — Toumey, *Garden and Forest*, viii. 22.

A tree, in Arizona rarely eighteen or twenty feet in height, with a trunk which is often crooked or slightly inclining, and is simple or furnished with two or three short erect branches, not more than ten inches in diameter, covered below with dark red-brown scaly bark from a third to a half of an inch in thickness, roughened for many years by the persistent scars of the leaf-bases, and clothed above by the pendent dead leaves of many seasons. The leaves are lanceolate, from two and a half to three feet in length, and gradually narrowed upward from the thin lustrous red base, which is three or three and a half inches in width, to above the middle, where they are an inch and a half broad; they are light yellow-green and smooth, with thick entire red-brown margins, which eventually separate sparingly into short thin smooth brittle threads, and are flat except toward the apex, where they gradually become strongly concave, and end in long rigid sharp light red-brown points, and toward the base, where they are slightly thickened and rounded. The flowers appear from July to September in an erect pedunculate panicle with a short rachis and stout slender branches growing from it at nearly right angles, and then turning abruptly upward, the whole clothed with loose hoary tomentum, which also covers the short stout erect or spreading pedicels; the bracts are lanceolate, white and fleshy, and vary from eighteen inches in length at the base of the panicle, where they terminate in long rigid points, to less than an inch on its ultimate divisions, where they are thin and membranaceous, often falling before the flowers. The perigone is from an inch to an inch and three quarters long, and on the outer surface is pubescent at the base, its broad oval or oblong-obovate thin segments being tipped at the apex with conspicuous clusters of white tomentum, and often slightly pilose on the back. The stamens are not more than two thirds as long as the ovary, with flattened filaments pilose from the base, and only slightly enlarged at the apex. The ovary is cylindrical, gradually narrowed above, and crowned by a short stout deeply lobed style. The fruit, which in Arizona is produced sparingly, and ripens in October and November, is pendulous, indehiscent, slightly angled, from three and a half to four inches in length, about an inch and a quarter in thickness, often narrowed above the middle, tipped by a stout thick point, and surrounded at the base with the remains of the perigone; at first pale green when fully grown, it turns orange-color and finally black in ripening; the flesh is thin, sweet, and succulent, and closely invests the thin light brown inner coat. The seeds are a quarter of an inch broad, and about an eighth of an inch thick, with thin conspicuous marginal rims.

In the United States, where it is nowhere abundant, *Yucca Schottii* inhabits the dry slopes of the mountain ranges of Arizona adjacent to the Mexican boundary, usually at elevations of between five and six thousand feet above the level of the sea, but occasionally following their cañons down to the high mesas at their base, and ranges southward through Sonora.

The wood of *Yucca Schottii* has not been examined.

Yucca Schottii was discovered by Mr. A. Schott[1] in June, 1849, in the valley of the Santa Cruz River in northern Sonora.

[1] Arthur Carl Victor Schott (February 27, 1814–July 26, 1875) was born in Stuttgart, and educated in the gymnasium and the technical school of his native city. After graduating at the age of fifteen he worked as an apprentice for a year in the Royal Gardens of Stuttgart preparatory to entering the Institute of Agriculture at Hohenheim. When he had thus completed his education Schott managed various rural estates in Germany, and then took charge of a mining property in Hungary, where he remained for ten years, devoting himself assiduously to the study of botany, geology, and zoölogy. In 1848 he traveled through southern Europe, Turkey, and Arabia, and in August, 1850, came to America, where he obtained employment in the office of the United States Topographical Engineers at Washington. A few years later, upon the recommendation of Dr. John Torrey, he was appointed a member of the scientific corps of the commission established to fix the boundary between the United States and Mexico, and was given charge of one of the surveying parties. In addition to his regular work as one of the surveyors of the Commission, Mr. Schott formed large botanical collections, made the sketches of the scenery which accompanied the reports of Lieutenant Michler, published in the general Boundary Report and in separate memoirs, and also sketched the geology of the lower Rio Grande, and wrote the account of the geology of the territory lying between the one hundred and eleventh degree of longitude and the initial point on the Colorado River of the West. In 1857, his work in connection with the Mexican Boundary Commission being completed, he became a member of a Government Commission to survey the Atrato River in the United States of Colombia, serving there for several months, and returning with the Commission to Washington, where its report was completed in 1864.

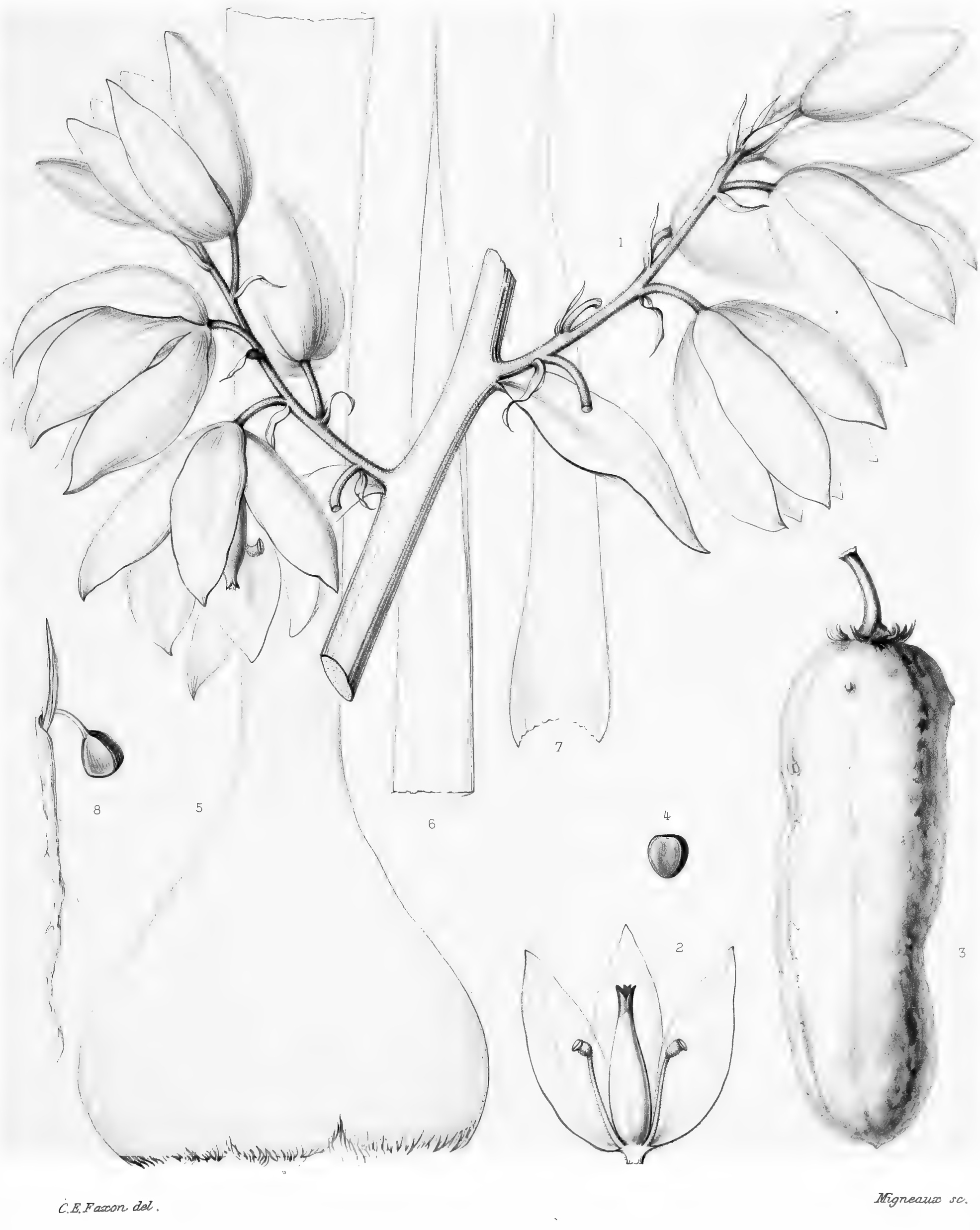
In 1864 Mr. Schott was commissioned by Governor Salazar of Yucatan to make a geological survey of that State, and was engaged on this work until 1866, when it was interrupted by political revolutions. He was afterwards employed in the Topographical Bureau of the War Department of the United States, and then, until his death, in the office of the Coast Survey.

Mr. Schott is described as a man of many talents, a good linguist, an accomplished scholar and artist, and a thorough naturalist. He was an indefatigable worker, careful and systematic in his methods, and untiring in his efforts to advance the cause of science.

EXPLANATION OF THE PLATE.

PLATE DI. YUCCA SCHOTTII.

1. Portion of a flowering panicle, natural size.
2. Vertical section of a flower, natural size.
3. A fruit, natural size.
4. A seed, natural size.
5. The base of a leaf, natural size.
6. The point of a leaf, natural size.
7. A bract from the base of an inflorescence, natural size.
8. A seedling, natural size.



C.E. Faxon del. Migneaux sc.

YUCCA SCHOTTII, Engelm.

A. Riocreux dirext. Imp. J. Taneur, Paris.

YUCCA ARBORESCENS.

Joshua Tree.

LEAVES concave above the middle, blue-green, sharply serrate.

Yucca arborescens, Trelease, *Rep. Missouri Bot. Gard.* iii. 163, t. 5, 49 (1893). — Coville, *Contrib. U. S. Nat. Herb.* iv. 201, t. (*Bot. Death Valley Exped.*).

Yucca Draconis, var. **arborescens**, Torrey, *Pacific R. R. Rep.* iv. pt. v. 147 (1857).

Yucca brevifolia, Engelmann, *Watson King's Rep.* v. 496 (1871); *Trans. St. Louis Acad.* iii. 47. — Parry, *Am. Nat.* ix. 141, 351. — Watson, *Proc. Am. Acad.* xiv. 252. — Baker, *Jour. Linn. Soc.* xviii. 221. — Brewer & Watson, *Bot. Cal.* ii. 164. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 218. — *Gard. Chron.* ser. 3, i. 772, f. 145. — S. B. Parish, *Garden and Forest*, iv. 135; *Zoë*, iv. 349. — Trelease, *Rep. Missouri Bot. Gard.* iv. 193, t. 6–9, 21.

A tree, from thirty to forty feet tall, with stout tough roots descending deeply into the soil from a broad thick basal disk from which the trunk rises abruptly. Until the stem attains a height of eight or ten feet it is simple and clothed to the ground with leaves which are erect until after the appearance of the first panicle of flowers, when they spread at right angles, and, finally becoming reflexed, do not disappear for many years; after flowering the stem forms two or three branches, ultimately becomes two or three feet in diameter, covered, like the short stout limbs, with gray bark from an inch to an inch and a half in thickness, and deeply divided into oblong plates frequently two inches in length, and bears a broad and often symmetrical head formed by the continued forking of the branches at the base of the terminal flower-clusters. The rigid leaves, which are crowded in densely imbricated clusters at the end of the branches, are lanceolate, and taper gradually or rarely are slightly contracted above the bright red-brown lustrous base, which is from an inch and a half to two inches wide; they are from five to eight, or rarely on vigorous young plants ten or twelve inches in length, and from one quarter to one half of an inch in width; they are concave above the middle, flat or only slightly concave toward the base, tipped with sharp gradually tapering dark red-brown points from one half to three quarters of an inch long, bluish green and glaucous, and smooth or slightly roughened, with thin yellow margins armed with sharp minute teeth. The flowers appear from March until the beginning of May, the creamy white closely imbricated bracts of the panicle, which are often flushed with purple at the apex, forming before its appearance a conspicuous conical cone-like bud eight or ten inches in length. The panicle is nearly sessile, pubescent, densely flowered, fifteen or sixteen inches long and about eight inches broad, with a stout rachis an inch and a half thick at the base, and gradually tapering to the apex, and short stout branches; the lower bracts are sterile, and, although rather shorter, resemble the leaves except at the base, which is oblong, leathery, creamy white, about two and a half inches long and an inch and a quarter broad; by the gradual lengthening of the wide base and the shortening of the green leaf-like tip, the inner bracts, from which the branches of the inflorescence spring, are oblong-ovate or oblong-obovate, acuminate, leathery, creamy white, and seven or eight inches long, and from one to two inches broad, gradually decreasing in size toward the apex of the panicle, those at the base of the upper branches being not more than three inches in length; the lowest fertile bract bears one or two flowers in its axil; and at the base of each branch are usually two solitary flowers, while the rest of its flowers, eight or ten in number, are arranged above its middle, each in the axis of a creamy white bract, the bracts decreasing in size toward the end of the branch, the largest being about an inch and a half long and a quarter of an inch broad, and the smallest not more than half that size. The flowers, which vary from globose to oblong in shape and from one to two inches in length, are greenish white, waxy, and dull or lustrous, and emit a strong and rather disagreeable odor;

the segments of the perigone, which are united at the base into a short tube, are keeled on the back, thin below the middle, and gradually thickened upward above it to the much thickened concave incurved rounded tip, those of the outer rank being rather broader and thicker and more prominently keeled than those of the inner rank; they are glabrous with the exception of a few scattered hairs at the base and at the apex, or are covered with pubescence on the outer surface. The stamens are about half as long as the ovary, with filaments which are villous-papillate from the base, flattened below by pressure against the ovary, spreading above and clavately thickened toward the apex, and with anthers which do not open and discharge their pollen until the second evening after the expansion of the flowers.[1] The ovary is sessile, conical, three-lobed above the middle, and bright green, with narrow slightly developed septal nectar glands,[2] and is crowned with a sessile nearly equally six-lobed star-like white stigma penetrated by a wide stigmatic canal. The fruit, which ripens in May or June, is spreading or more or less pendent at maturity, oblong-ovate, acute, and tipped at the apex by the point of the ovary and the stigma, surrounded at the base by the withered remnants of the perigone, slightly three-angled, from two to four inches long and from an inch and a half to two inches broad, light reddish or yellow brown and indehiscent, although when thoroughly dry showing a tendency to split between the primary dissepiments; the outer coat, which is sometimes a quarter of an inch thick, becomes dry and spongy in texture as the fruit ripens, and closely invests the light brown case-like inner coat. The seeds are sometimes nearly half an inch in length, rather less in breadth, and not quite one sixteenth of an inch in thickness, with broad well-developed margins to the rim, and large conspicuous hilums.

Yucca arborescens is distributed from southwestern Utah to the western and northern rims of the Mohave Desert in California, inhabiting the high gravelly slopes which border arid plains and the lower slopes of dry mountain ranges, and, in distinct zones and belts, forming open forests often of considerable extent. In Utah, where it rarely exceeds ten feet in height, it forms such a belt five or six miles wide on the western slope of the Beaverdam Mountains, at elevations of between 2,300 and 4,400 feet above the level of the sea. In southern and southwestern Nevada it is not uncommon at the base of many of the mountain ranges, often growing in forests of considerable extent at elevations of nearly 7,000 feet, and ranging northward nearly to the thirty-eighth degree of latitude; in northwestern Arizona it is found in a scattered belt in the valley of the Virgin River, and extends southward over the low divide between the Detrital and Sacramento valleys; and in California it abounds on the Mohave Desert, where it grows to its largest size, making a belt several miles wide along the western margin of the desert, covering the northern foothills of the San Bernardino Mountains up to elevations of nearly 4,000 feet, spreading westward up Antelope Valley, and along the northern side of the desert to the foothills of the Tehachapi Mountains with forests sometimes twelve miles wide, and extending with small and isolated groves nearly to Walker Pass, where it becomes abundant again.[3]

The wood of *Yucca arborescens* is light, soft, spongy, difficult to work, very light brown or nearly white. The specific gravity of the absolutely dry wood is 0.3737, a cubic foot weighing 23.29 pounds. It has been made into pulp for the manufacture of paper,[4] and is cut into thin layers, which are used as wrapping material or manufactured into boxes and other small articles.

The seeds are gathered and eaten by the Indians, who grind them into meal.[5]

[1] Trelease, *Rep. Missouri Bot. Gard.* iv. 195.

[2] Trelease, *l. c.*

[3] Merriam, *North American Fauna*, No. 7, 352, t. (*Death Valley Exped.* ii.).

[4] About twenty-five years ago at Ravenna in the Solidad Pass, just south of the Mohave Desert in California, a company of English capitalists established a mill for the manufacture of the wood of *Yucca arborescens* into paper-pulp. A quantity of paper was made from the pulp, and it is said that several editions of the *London Telegraph* were printed upon it; but the high cost of manufacture more than consumed the profits of the enterprise, and it was soon abandoned. (See Shinn, *Am. Agric.* l. 689.)

[5] Palmer, *Am. Nat.* xii. 647.

First noticed by Frémont in 1844 on the Mohave Desert,[1] the Joshua Tree, as it was called by the Mormons of southern Utah, was not described until many years later.

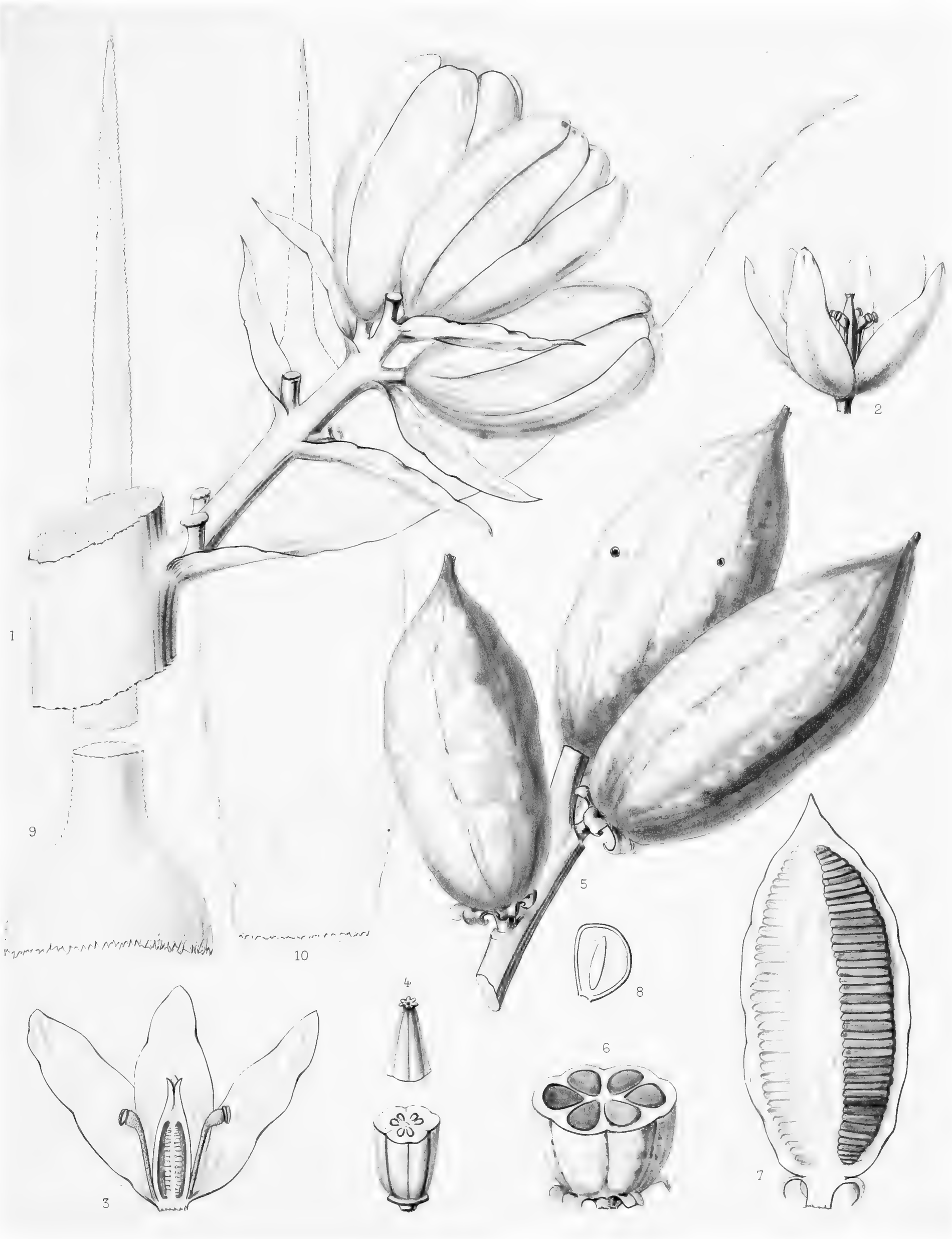
Railroads now cross the Mohave Desert, and from the window of his car the traveler can see the forests of *Yucca arborescens* stretching indefinitely into the hazy distance, unlike any other forest on the continent, and without a rival in singularity and weirdness.

[1] "We continued in a southerly direction across the plain, to which, as well as to all the country so far as we could see, the Yucca trees gave a strange and singular character." (Frémont, *Rep.* 257.)

EXPLANATION OF THE PLATE.

PLATE DII. YUCCA ARBORESCENS.

1. A branch of a flowering panicle, natural size.
2. A small pubescent flower, natural size.
3. Vertical section of a flower, natural size.
4. A pistil divided transversely, enlarged.
5. Portion of a branch of a fruiting panicle, natural size.
6. Cross section of a fruit, natural size.
7. Vertical section of a fruit, natural size.
8. Vertical section of a seed, enlarged.
9. A leaf, natural size.
10. A bract from the base of an inflorescence, natural size.



C.E. Faxon del. Himely sc.

YUCCA ARBORESCENS, Trel.

A. Riocreux direx.t Imp. J. Taneur, Paris.

YUCCA GLORIOSA.

Spanish Dagger.

LEAVES thin, flat, or concave toward the apex, rough on the lower surface, dull or glaucous green.

Yucca gloriosa, Linnæus, *Spec.* 319 (1753). — Miller, *Dict.* ed. 8, No. 1. — Schoepf, *Mat. Med. Amer.* 48. — Walter, *Fl. Car.* 124. — Aiton, *Hort. Kew.* i. 465. — Salisbury, *Prodr.* 246. — Willdenow, *Spec.* ii. pt. i. 183. — Michaux, *Fl. Bor.-Am.* i. 196. — Persoon, *Syn.* i. 378. — Andrews, *Bot. Rep.* vii. t. 473. — Desfontaines, *Hist. Arb.* i. 18. — *Bot. Mag.* xxxi. t. 1260. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 201. — Pursh, *Fl. Am. Sept.* i. 228. — Redouté, *Liliacées*, vi. t. 326, 327. — Nuttall, *Gen.* i. 218. — Haworth, *Suppl. Pl. Succ.* 37. — Elliott, *Sk.* i. 400. — Sprengel, *Syst.* ii. 41. — Roemer & Schultes, *Syst.* vii. pt. i. 720. — Dietrich, *Syn.* ii. 1094. — Kunth, *Enum.* iv. 273. — Spach, *Hist. Vég.* xii. 286. — Regel, *Gartenflora*, viii. 36. — Chapman, *Fl.* 485. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 94. — Engelmann, *Trans. St. Louis Acad.* iii. 38, 211, 213. — K. Koch, *Dendr.* ii. pt. ii. 343. — Hemsley, *The Garden*, viii. 133, f. — Watson, *Proc. Am. Acad.* xiv. 251. — Baker, *Refugium Bot.* v. t. 320; *Jour. Linn. Soc.* xviii. 225. — Trelease, *Rep. Missouri Bot. Gard.* iii. 163, t. 6, 7, 50; iv. 199.

Yucca integerrima, Stokes, *Bot. Mat. Med.* ii. 267 (1812).

Yucca obliqua, Haworth, *Syn. Pl. Succ.* 69 (1812); *Suppl. Pl. Succ.* 37. — Sprengel, *Syst.* ii. 41. — Roemer & Schultes, *Syst.* vii. pt. i. 721. — Kunth, *Enum.* iv. 274. — Spach, *Hist. Vég.* xii. 287. — Regel, *Gartenflora*, viii. 36; xvii. t. 580.

Yucca acuminata, Sweet, *Brit. Fl. Gard.* ii. t. 195 (1827). — Kunth, *Enum.* iv. 274. — Spach, *Hist. Vég.* xii. 287. — Baker, *Gard. Chron.* 1870, 1123; *Refugium Bot.* v. t. 316.

Yucca gloriosa maculata, Carrière, *Rev. Hort.* 1859, 430.

Yucca gloriosa glaucescens, Carrière, *Rev. Hort.* 1860, 360.

Yucca gloriosa nobilis, Carrière, *Rev. Hort.* 1860, 360.

Yucca gloriosa nobilis parviflora, Carrière, *Rev. Hort.* 1860, 361.

Yucca gloriosa minor, Carrière, *Rev. Hort.* 1860, 361. — Baker, *Refugium Bot.* v. t. 319; *Jour. Linn. Soc.* xviii. 225.

Yucca gloriosa mollis, Carrière, *Rev. Hort.* 1860, 362.

Yucca gloriosa tristis, Carrière, *Rev. Hort.* 1860, 363.

Yucca gloriosa acuminata, Carrière, *Rev. Hort.* 1868, 157. — Baker, *Jour. Linn. Soc.* xviii. 226.

Yucca gloriosa robusta, Carrière, *Rev. Hort.* 1868, 158.

Yucca patens, André, *Ill. Hort.* 1870, 121, t.

Yucca tortulata, Baker, *Gard. Chron.* 1870, 1122.

Yucca pruinosa, Baker, *Gard. Chron.* 1870, 1122.

Yucca Boerhaavii, Baker, *Gard. Chron.* 1870, 1217; *Jour. Linn. Soc.* xviii. 224.

Yucca Ellacombei, Baker, *Refugium Bot.* v. t. 317 (1872).

Yucca gloriosa, var. **obliqua**, Baker, *Jour. Linn. Soc.* xviii. 225 (1881).

Yucca gloriosa, var. **Ellacombei**, Baker, *Jour. Linn. Soc.* xviii. 226 (1881).

Yucca gloriosa, var. **tortulata**, Baker, *Jour. Linn. Soc.* xviii. 226 (1881).

Yucca gloriosa, var. **pruinosa**, Baker, *Jour. Linn. Soc.* xviii. 226 (1881).

On the coast of South Carolina a tree, with a stem which varies from a few inches to six or eight feet in height and from four to six inches in diameter, simple or rarely furnished with a few short branches, and usually clothed to the base with pendent dead leaves; or in the gardens of more temperate regions often larger, with a stout trunk covered with smooth thick light gray bark. The leaves are from two to two feet and a half in length, gradually narrowed above the broad base, and then gradually broadened to above the middle, where they vary from one and a half to two and a half inches in width; they are thin, flat, or slightly concave toward the apex, which is tipped with a stout dark red point, frequently longitudinally folded, dull and often glaucous green, and roughened on the under surface, especially above the middle, with margins which at first are pale and serrulate toward the base of the leaf but soon grow dark reddish brown, and usually, losing their teeth and becoming brittle, crumble away or occasionally separate into thin fibres. The flowers generally appear in October, or occasionally on some plants as early as July, in pubescent or glabrous panicles tapering toward

both ends, from two to four feet long, from twelve to eighteen inches in diameter, and raised on stout peduncles which are sometimes three or four feet in length, although frequently shorter, and are furnished with creamy white acute bracts often flushed with purple toward the apex, and forming before the panicle emerges a conspicuous egg-shaped bud from four to six inches long; the first fertile bracts bear in their axils one or usually two flowers; higher on the panicle the bracts are smaller, and at the base of the pedicels at the extremities of its branches they are often less than an inch in length. The perigone when fully expanded is from three and a half to four inches across, with thin ovate acute or lance-ovate creamy white segments often tinged externally with green or purple, slightly united at the base, and pubescent at the apex. The stamens are about as long as the ovary, with filaments which at first are erect or patulous but commonly become recurved or variously twisted, and are hispid or slightly papillose, and with anthers which are usually deeply emarginate at the apex. The ovary is sessile, slightly lobed and six-sided, light green, and gradually narrowed upward into elongated divergent stigmatic lobes thickened on the back and emarginate at the apex. The fruit, which is rarely produced,[1] is indehiscent, pendulous, about three inches long and an inch in diameter, cuspidate at the apex, and raised on a short stout stipe; when fully grown it is hexagonal, prominently six-ridged, with three wide sides corresponding to the backs of the carpels and three alternate much narrower depressed sides; and at maturity the thick outer coat becomes thin, leathery, and almost black, and closely invests the thin firm light brown inner coat. The seeds are a quarter of an inch wide and about one thirty-second of an inch thick, with smooth testas and uniform albumen.[2]

[1] Only two authentic instances of plants of *Yucca gloriosa* producing fruits are recorded. Several years ago Dr. J. H. Mellichamp noticed ripe fruit on a plant near Bluffton, South Carolina, which had bloomed early in the season, and in the autumn of 1873 a plant in the congressional gardens in Washington bore a number of fruits which contained fertile seeds. Plants of *Yucca gloriosa* or of some of its forms are said to have borne abortive fruits and even mature fruits with fertile seeds in Europe (see Ellacombe, *Gard. Chron.* n. ser. xiii. 21; xxiv. 628), but such statements must be accepted with caution, for the determination of the species of cultivated Yuccas is difficult and uncertain, and *Yucca aloifolia*, which frequently fruits in European gardens, is often mistaken for *Yucca gloriosa* or for one of its varieties. This habitual infertility is probably due to the absence of a Pronuba in the autumn, when this species generally flowers; and in the rare instances when it has fruited the plants had flowered early in the season before the disappearance of *Pronuba yuccasella*, which no doubt visits early blooming individuals and secures the pollination of their flowers. It is hardly possible that the existence of this species can always have been dependent upon the occasional production of summer flowers and the chances of their fertilization; it seems more probable that it was formerly visited by an autumn Pronuba which has now become extinct, as Kerner von Marilaun suggests (*Pflanzenleben*, ii. 155); or that it was brought without its peculiar Pronuba to Carolina by man or by ocean currents from the coast of some of the West Indian islands, or of Mexico or the Spanish main. The fact that *Yucca gloriosa* attains a larger size in warmer regions than on the Carolina coast may seem to indicate its introduction from a more southern latitude; but, on the other hand, it has proved in cultivation one of the hardiest Yuccas, able to thrive, although in a stemless form, in regions with much severer climates than that of Carolina. It is not easy to account for its spontaneous spread along the Carolina coast from one or even several introduced individuals, as it usually produces no seed there; and as it is not known to grow naturally or even spontaneously elsewhere, it may perhaps best be considered a native of the coast of Carolina, where, for at least a hundred and fifty years, it has been growing apparently naturally and as plentifully as at the present time.

[2] Slight variations in foliage or in the habit of young flowerless individuals of this species cultivated in gardens have been seized upon by European botanists as evidences of distinct species, and the greatest confusion in the names of cultivated Yuccas has resulted. The following forms, not known now to occur on the Carolina coast but frequently cultivated, are distinguished by Engelmann: —

Yucca gloriosa, var. *plicata*, Carrière, *Rev. Hort.* 1860, 359. — Engelmann, *Trans. St. Louis Acad.* iii. 39. — Baker, *Jour. Linn. Soc.* xviii. 225.

In this form the leaves are conspicuously plicate, the upper and inner being erect and the lowest spreading.

Var. γ *recurvifolia*, Engelmann, *l. c.* (1873). — Baker, *l. c.*

Yucca recurvifolia, Salisbury, *Parad. Lond.* i. t. 31 (1806). — Pursh, *Fl. Am. Sept.* i. 228. — Nuttall, *Gen.* i. 218. — Elliott, *Sk.* i. 401. — Kunth, *Enum.* iv. 272. — Spach, *Hist. Vég.* xii. 286. — Chapman, *Fl.* 485. — Baker, *Refugium Bot.* v. t. 326. — Hemsley, *The Garden*, viii. 133, f.

Yucca recurva, Haworth, *Syn. Pl. Succ.* 67 (1812); *Suppl. Pl. Succ.* 35. — Sprengel, *Syst.* ii. 41. — Roemer & Schultes, *Syst.* vii. pt. i. 719. — Dietrich, *Syn.* ii. 1094. — *The Garden*, xlvii. 337, f.

Yucca rufocincta, Haworth, *Suppl. Pl. Succ.* 37 (1819). — Regel, *Gartenflora*, viii. 36.

Yucca superba, Haworth, *l. c.* 36 (1819). — *Bot. Reg.* xx. t. 1690. — Roemer & Schultes, *Syst.* vii. pt. i. 720. — Kunth, *l. c.* 273. — Spach, *Hist. Vég.* xii. 286.

Yucca pendula, Carrière, *Rev. Hort.* 1859, 488, t. 104. — *The Garden*, xliii. 455, f.

Yucca gloriosa nobilis, Carrière, *l. c.* 1868, 157.

Yucca gloriosa, var. *superba*, Baker, *Jour. Linn. Soc.* xviii. 225 (1881).

In this, one of the commonest forms of cultivated Yuccas, the leaves are glaucous while young and are thin and recurved; the

Yucca gloriosa inhabits the coasts and islands of South Carolina, in the immediate neighborhood of the sea, where it grows among sand-dunes and on the borders of beaches, and is exceedingly rare.

The wood of *Yucca gloriosa* has not been examined.

Yucca gloriosa, notwithstanding its rarity in its native country, was one of the first species of the genus cultivated in Europe,[1] where several forms are recognized, and it is now found in the gardens and pleasure grounds of all temperate countries.[2]

panicle is puberulous, and the filaments, which equal the pistil in length, are slightly papillose.

By Engelmann (*Trans. St. Louis Acad.* iii. 41), *Yucca ensifolia* (Baker, *Gard. Chron.* 1870, 1217; *Refugium Bot.* v. t. 318) and *Yucca Ellacombei* (Baker, *Refugium Bot.* t. 317 [1873] are considered forms connecting his variety *recurvifolia* with the typical plant.

Yucca gloriosa, var. δ *planifolia* (Engelmann, *l. c.* 39 [1873]) is based on a single specimen, cultivated in the Botanic Garden at Genoa as *Yucca glauca*, with a short trunk, long, narrow, and not at all plicated leaves, smaller whitish flowers with filaments as long as the pistil, and small anthers entire above.

[1] Yucca or Jucca, Gerarde, *Herball*, 1359. — Ray, *Hist. Pl.* ii. 1201.

Yucca foliis Aloes, C. Bauhin, *Pinax*, 91. — Boerhaave, *Ind. Alt. Hort. Lugd. Bat.* ii. 132.

Iucca sive Yucca, India putata. — Parkinson, *Theatr.* 153, f.

Yuca sive Iucca, Parkinson, *Parad.* 434, f.

Yucca sive Iucca vera foliis Aloes, Morison, *Pl. Hist.* ii. 419, t. 23, f. 1.

Yucca foliorum margino integerrimo, Linnæus, *Hort. Cliff.* 130; *Hort. Ups.* 88.

Yucca foliis integerrimis, Linnæus, *Virid. Cliff.* 29.

Cordyline foliis pungentibus integerrimis, Royen, *Fl. Leyd. Prodr.* 22.

Yucca Indica, foliis aloes, Barrelier, *Icon. Pl.* 70, t. 1194 (*teste* Linnæus, *Spec.* 319).

[2] Varieties with leaves striped with white or yellow are occasionally cultivated in European gardens as *Yucca pendula variegata*, Carrière (*Rev. Hort.* 1875, 400), *Yucca gloriosa medio picta*, and *Yucca gloriosa marginata*, Carrière (*l. c.* 1880, 259).

In European gardens, *Yucca gloriosa recurvifolia* is sometimes cultivated as *Yucca Japonica* (see Carrière, *l. c.* 1859, 488).

EXPLANATION OF THE PLATE.

Plate DIII. Yucca gloriosa.

1. Branch of a flowering panicle, natural size.
2. Vertical section of a flower, natural size.
3. Portion of a fruiting panicle, natural size.
4. Cross section of a fruit, natural size.
5. Vertical section of a seed, enlarged.
6. A leaf, natural size.

C.E.Faxon del.

Himely sc.

YUCCA GLORIOSA A.L.

A.Riocreux direx.t

Imp. J. Taneur, Paris.

YUCCA CONSTRICTA.

Spanish Dagger.

LEAVES thin and flat, filamentose on the margins, smooth, pale yellow-green.

Yucca constricta, Buckley, *Proc. Phil. Acad.* 1862, 8. — Baker, *Jour. Linn. Soc.* xviii. 229. — Hemsley, *Bot. Biol. Am. Cent.* iii. 370.

Yucca polyphylla, Baker, *Gard. Chron.* 1870, 1088.

Yucca angustifolia, *β* **radiosa**, Engelmann, *Watson King's Rep.* v. 496 (1871).

Yucca angustifolia, *β* **elata**, Engelmann, *Trans. St. Louis Acad.* iii. 50 (1873); *Rothrock Wheeler's Rep.* vi. 270.

Yucca elata, Engelmann, *Bot. Gazette*, vii. 17 (1882). — Sargent, *Forest Trees North Am. 10th Census U. S.* ix. 219; *Garden and Forest*, ii. 569, f. 146. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 437 (*Man. Pl. W. Texas*). — Toumey, *Garden and Forest*, viii. 22.

A tree, with a trunk often ten or twelve feet in height and seven or eight inches in diameter, covered above with a thick thatch of the pendent dead leaves of many years, and below with dark brown irregularly fissured bark broken into thin plates and about a quarter of an inch in thickness, often simple and sometimes beginning to flower when only a few inches tall, or branched with many short stout branches densely covered with leaves which are at first erect, then spread nearly at right angles and are pendulous at the bottom of the clusters, and a tough and much-branched underground stem penetrating deeply into the soil. The leaves are lanceolate and rigid, gradually diminish in width from the thin base, which is from two to two and a half inches broad and white and marked with an orange-colored band where it narrows into the blade, and taper toward the apex or are sometimes somewhat broader at the middle than below; they are thin and flat on the upper surface, slightly thickened and rounded on the back toward the base, tipped with slender stiff red-brown points from one half to three quarters of an inch long, smooth, pale yellow-green, from twenty to thirty inches in length and from one quarter to one half of an inch wide, with thickened entire pale margins which soon split into numerous long slender filaments; or on young plants or at the base of the panicle of flowers they are often not more than a foot long and an eighth of an inch wide. The flowers, which open in May and June, are borne on slender spreading or more or less recurved pedicels in glabrous much-branched panicles from four to six feet in length and raised on stout naked stems from three to seven feet long; their bracts are ovate, acute, white, membranaceous, deciduous, and from four to six inches in length, or toward the apex of the panicle not more than an inch long. The perigone is ovate and acute in the bud, and when fully expanded is from three and a half to four inches across; the segments are thin and creamy white and united at the base into a short slender distinct tube, ovate or slightly obovate and tipped by small pubescent mucros, those of the outer rank being usually acute and not more than half as broad as those of the inner rank, which are often an inch wide and are frequently rounded at the apex. The stamens are as long as the ovary or a little longer, with slender nearly terete villous-papillate filaments, and anthers which discharge their pollen when the flowers first open.[1] The ovary is sessile, almost terete, furnished with well developed active septal nectar glands,[2] pale green and abruptly contracted into a stout white style from one quarter to one third of an inch long and crowned by white stigmatic lobes slightly thickened dorsally. The fruit is an erect oblong capsule rounded and obtuse at both ends, tipped by a short stout mucro, raised on a short thickened stipe, conspicuously three-ribbed with rounded ridges on the backs of the carpels, from an inch and a half to two inches in length and from an inch to an inch and a half wide, with a thin firm light brown ligneous outer coat closely adherent to the slightly thinner tough inner coat which is lustrous, light yellow, and marked with

[1] Trelease, *Trans. St. Louis Acad.* iv. 203.

[2] Trelease, *l. c.* 202.

broad brown bands on the inner surface; in ripening the capsule splits from top to bottom between the carpels and through their backs at the apex only where a triangular opening is made from which the seeds are gradually scattered, the empty capsule often persisting until the following season on the panicle, whose base often remains for many years pressed close against the side of the lengthening stem of the plant. The seeds are one third of an inch wide and about one thirty-second of an inch thick, with a smooth testa, thin brittle wide margins to the rim, and uniform albumen.

Yucca constricta inhabits high desert plateaus, and is distributed from southwestern Texas to southern Arizona and southward in northern Mexico. Rarely exceeding six feet in height in Texas, where it is less abundant than farther west, *Yucca constricta* grows in the greatest profusion and attains its largest size on the eastern slope of the low continental divide in southern New Mexico and along the northern rim of the Tucson Desert in Arizona, and is found scattered in countless millions over the high mesas of many of the valleys of southern New Mexico and Arizona.[1]

The wood of *Yucca constricta* is light, soft, spongy, and pale brown or yellow. The specific gravity of the absolutely dry wood is 0.4470, a cubic foot weighing 27.86 pounds.

The young panicles, before their branches unfold, are eaten by Indians and Mexicans.[2]

Yucca constricta was discovered by Dr. A. Wislizenus[3] in the valley of the Rio Grande above El Paso in July, 1846, and the following April it was found in flower by Mr. Josiah Gregg[4] near the city of Chihuahua.

In appearance *Yucca constricta* is one of the most remarkable of North American trees, with its trunk slender below but thick above from the mass of dead leaves which inclose it, and its broad disheveled head of long narrow crowded leaves; and when its great flower-clusters, raised high in the air on long slender staffs, wave like snowy banners over the desert, it perhaps surpasses all other Yuccas in beauty.

[1] The narrow-leaved stemless Yucca of southeastern Utah, which has been referred to this species (Engelmann, *King's Rep.* v. 497. — Merriam, *North American Fauna*, No. 7, 358 [*Death Valley Exped.* ii.]. — Coville, *Contrib. U. S. Nat. Herb.* iv. 203 [*Bot. Death Valley Exped.*] [as *Yucca radiosa*]), is probably an undescribed species common on the Colorado plateau, over which, in so far as I have been able to observe, *Yucca constricta* does not extend.

[2] Palmer, *Am. Nat.* xii. 646.

[3] See vi. 94.

[4] See vi. 33.

EXPLANATION OF THE PLATE.

PLATE DIV. YUCCA CONSTRICTA.

1. An end of a branch of the flowering panicle, natural size.
2. Vertical section of a flower, natural size.
3. A stamen, enlarged.
4. A pistil, divided transversely, enlarged.
5. An ovule, enlarged.
6. The end of a branch of a fruiting panicle, natural size.
7. Portion of a capsule laid open.
8. A seed divided transversely, natural size.
9. Vertical section of a seed, enlarged.
10. The base of a leaf, natural size.
11. The point of a leaf, natural size.

C.E.Faxon del. *Rapine sc.*

YUCCA CONSTRICTA, Buckl.

A.Riocreux direx.t. *Imp. J. Taneur, Paris.*

OREODOXA.

Flowers monœcious, the staminate and pistillate on the same branches of an infrafoliar compound spadix; staminate flowers symmetrical; stamens 6, 9, or 12, ovary rudimentary; pistillate flowers smaller; staminodia 6, ovary subglobose, 2 to 3-celled, ovule solitary, lateral, ascending. Fruit drupaceous, 1-celled. Leaves alternate, equally pinnate.

Oreodoxa, Willdenow, *Mém. Acad. Berlin*, sér. 2, vi. 34 (1807). — Endlicher, *Gen.* 247. — Meisner, *Gen.* 355. — Bentham & Hooker, *Gen.* iii. 899. — Drude, *Engler & Prantl Pflanzenfam.* ii. pt. iii. 67. — Baillon, *Hist. Pl.* xiii. 356.

Lofty, or small and alpine, unarmed trees, with stout endogenous stems cylindrical, or swollen at the middle, marked for many years with the remote conspicuous scars of fallen leaves, often abruptly enlarged at the base, and crowned with slender bright green cylinders several feet in length formed by the closely imbricated sheaths of the leaf-stalks. Leaves terminal, alternate, equally pinnate, the pinnæ linear-lanceolate, long-pointed, plicately folded in æstivation, unequally two-cleft, inserted obliquely on the upper side of the rachis, folded together at the base, their midribs and margins thin; rachises convex on the back, above broad and three-ridged toward the base of the leaf and acute toward its apex; petioles semicylindrical, sulcate above, gradually enlarged into the thick elongated vaginas. Spadix large, decompound, produced near the base of the green part of the stem, its branches long and pendulous; spathes two, the outer semicylindrical, as long as the spadix, the inner ensiform, splitting ventrally, inclosing the branches of the spadix. Flowers minute, white, in a loose spiral, toward the base of the branch in three-flowered clusters with a central staminate and smaller lateral pistillate flowers, above the staminate solitary or in two-flowered clusters; bracts and bractlets obscure, caducous. Calyx of the staminate flower of three minute broadly ovate obtuse scarious sepals imbricated in æstivation, much shorter than the corolla. Petals three, nearly equal, ovate, or obovate, acute, connate at the base, coriaceous, slightly valvate in æstivation. Stamens six, nine, or twelve, exserted; filaments subulate, united below and adnate to the base of the corolla, slender and acute at the apex; anthers large, ovate-sagittate, attached on the back, versatile, two-celled, the cells free below, opening longitudinally. Ovary rudimentary, subglobose, or three-lobed. Pistillate flowers much smaller, ovoid-conical. Sepals subreniform, obtuse, imbricated in æstivation. Corolla urceolate, divided nearly to the middle into three acute erect lobes, incurved at the apex, valvate in æstivation. Staminodia six, scale-like, united into a cup adnate on the mouth of the corolla. Ovary superior, subglobose, obscurely two or three-lobed, gibbous, two or three-celled, crowned with a thick three-lobed stigma, the lobes ovate, acuminate, erect, becoming subbasilar on the fruit; ovule solitary, ascending, attached ventrally, semianatropous; micropyle extrorse, inferior. Fruit drupaceous, obovoid or oblong-ovoid, curved, one-celled; exocarp crustaceous, much thicker than the dry fibrous endocarp adnate to the seed. Seed oblong-reniform, marked with the conspicuous fibrous reticulate branches of the raphe radiating from the narrow basal hilum; testa thin, crustaceous; albumen uniform. Embryo cylindrical, minute, lateral, the radicle turned toward the base of the fruit.

Oreodoxa is confined to the New World, where four species are now recognized. Of these *Oreodoxa*

regia inhabits southern Florida, Cuba, and the Isthmus of Panama, *Oreodoxa oleracea*[1] the Antilles, *Oreodoxa Sancona*[2] the mountain valleys of Colombia, and *Oreodoxa frigida*,[3] a small alpine tree, the Andes of Ecuador.

The durable trunks of three of the species are used for wharf-piles and in construction; and the buds are cooked and eaten as a vegetable. The West Indian species are stately, graceful, magnificent trees, and are now cultivated in all tropical countries.[4]

The generic name, from ὄρος and δόξα, alludes to the lofty stature and mountain home of some of the species.

[1] Martius, *Hist. Nat. Palm.* iii. 166, t. 156, f. 1, 2, ; t. 163 (1833–50). — Kunth, *Enum.* iii. 181. — Spach, *Hist. Vég.* xii. 67. — A. Richard, *Fl. Cub.* ii. 276. — Grisebach, *Fl. Brit. W. Ind.* 517.

Areca oleracea, Jacquin, *Hist. Stirp. Am.* 278, t. 170 (1763); *Hist. Select. Stirp. Am.* 135, t. 235. — Linnæus, *Syst. Nat.* ed. 12, ii. 730. — Willdenow, *Spec.* iv. pt. i. 596. — Lunan, *Hort. Jam.* i. 133. — Maycock, *Fl. Barb.* 371.

Euterpe Caribœa, Sprengel, *Syst.* ii. 140 (1825).

One of the tallest and most beautiful of American Palms, *Oreodoxa oleracea*, the Cabbage Palm of the Antilles, sends up a stout trunk, sometimes nearly two hundred feet tall, surmounted by a crown of long arching graceful leaves frequently twenty feet in length and nearly six feet broad. Young trees are often destroyed by removing the terminal buds, which are eaten raw in salads, boiled like cabbages, or pickled. The clasping sheaths of the petioles serve as cradles for negro children, and are split into surgeons' splints; their thin inner coat when removed from the living leaf and dried resembles vellum, and can be used as a substitute for writing-paper, and from their fibres mats are woven. A sort of sago is manufactured from the pith of the stem, and an oil is obtained from the seeds. The stems split longitudinally, and, hollowed out by the removal of the spongy inner portion, are used for gutters; and the thin hard rind-like exterior is manufactured into canes, ramrods, and many small articles. (See Seemann, *Popular History of the Palms*, 277.)

The tall columnar stem and enormous crown of waving leaves of this Palm have delighted all travelers in the Antilles, and for two centuries and a half their chronicles have praised its beauty and extolled its value. (See Rochefort, *Histoire Naturelle et Morale des Isles Antilles*, 78. — Ligon, *A true and exact History of the Island of Barbados*, 125, t. — Labat, *Nouveau Voyage aux Isles de l'Amérique*, i. 420. — Sloane, *Cat. Pl. Jam.* 176; *Nat. Hist. Jam.* ii. 115, t. 215. — Browne, *Nat. Hist. Jam.* 342.)

[2] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* i. 304 (1815). — Kunth, *Syn. Pl. Æquin.* i. 306; *Enum.* iii. 182. — Roemer & Schultes, *Syst.* vii. pt. ii. 1491. — Spach, *l. c.* 69.

Œnocarpus Sancona, Sprengel, *l. c.* (1825).

Discovered by Humboldt on the mountains near the city of Carthagena, *Oreodoxa Sancona* is remarkable for its lofty stem, sometimes more than one hundred and fifty feet in height, and the durability of its wood, which is used in construction and is said to be so hard that it may turn the edge of a sharp axe. (See Kerchove, *Les Palmiers*, 262.)

[3] Humboldt, Bonpland & Kunth, *l. c.* (1815). — Kunth, *Syn. Pl. Æquin.* i. 307; *Enum.* iii. 183. — Roemer & Schultes, *l. c.*

Œnocarpus frigidus, Sprengel, *l. c.* (1825).

One of the most alpine of Palms, *Oreodoxa frigida* is not uncommon at elevations of ten thousand feet above the sea on the rocky slopes of the Andes of Zuindien, forming a stem only a few feet in height.

[4] H. Wendland, *Index Palmarum*, 31.

The great avenue of Palms in the Botanic Garden of Rio de Janeiro, which all travelers praise, is composed of *Oreodoxa oleracea*. (See L. & E. C. Agassiz, *Journey to Brazil*, 61, t.)

OREODOXA REGIA.

Royal Palm.

SPADIX puberulous. Fruit oblong-obovate. Pinnæ linear, acuminate. Stem enlarged near the middle.

Oreodoxa regia, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* i. 305 (1815). — Kunth, *Syn. Pl. Æquin.* i. 307; *Enum.* iii. 182. — Martius, *Hist. Nat. Palm.* iii. 168, t. 156, f. 3–5. — Spach, *Hist. Vég.* xii. 68. — Roemer & Schultes, *Syst.* vii. pt. ii. 1491. — A. Richard, *Fl. Cub.* iii. 276. — *Ill. Hort.* ii. 28, t. — Walpers, *Ann.* v. 807. — Grisebach, *Fl. Brit. W. Ind.* 517. — Sauvalle, *Fl. Cub.* 153. — Eggers, *Bull. U. S. Nat. Mus.* No. 13, 100 (*Fl. St. Croix and the Virgin Islands*). — Chapman, *Fl.* ed. 2, *Suppl.* 651. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 218. — Beccari, *Reliquiæ Schefferianæ*, 147, t. 11.

Œnocarpus regius, Sprengel, *Syst.* ii. 140 (1825).

Oreodoxa oleracea (?), Cooper, *Smithsonian Rep.* 1860, 440 (1861).

A tree, from eighty to one hundred feet in height, with a trunk rising from an abruptly enlarged base, gradually tapering from the middle to both ends and often two feet in diameter, covered with light gray rind tinged with orange-color, marked with regular dark blotches and irregularly broken into minute plates, and surmounted with a slender dark green and lustrous cylinder eight or ten feet in length. The leaves are ten or twelve feet long, closely pinnate with numerous linear acuminate pinnæ which are longest near the base of the leaf, where they are from two and a half to three feet in length and an inch and a half in width, and gradually decrease in size toward the apex of the leaf; they are deep green, with slender rather conspicuous veins, and covered on the lower surface with minute pale glandular dots, and are inserted obliquely on the upper side of the rachis; this is convex on the back and covered by dark scurfy scales, and nearly flat on the upper side, although slightly concave between the central and the prominent marginal ridges at the base, and, gradually decreasing in width from below upward, becomes thin and acute at the apex of the leaf; the petioles are almost terete, except at the base, where they become concave with thin edges separating irregularly into pale fibres as they enlarge into the bright green cylindrical clasping bases which are eight or nine feet in length and more or less thickly covered on the back with dark chaffy scales. The spadix is about two feet long, with a nearly terete peduncle an inch in diameter and slightly ridged longitudinally, and primary and secondary branches compressed above, abruptly enlarged at the base, concave on the upper side and convex on the lower, the flower-bearing branchlets being simple, slender, terete except at the very base, flexuous, long-pointed, from three and a half to five inches long, pendent, and rather closely pressed against the secondary branches. The flowers, which in Florida open in January and February, are subtended by triangular subulate caducous membranaceous white bracts and are bibracteolate with minute triangular bractlets, the staminate flowers being nearly a quarter of an inch in length and rather more than twice as long as the pistillate. The fruit is oblong-obovate, full and rounded at the apex, narrowed at the base, which is surrounded by the remnants of the perianth of the flower, violet-blue, and about half an inch long, with a thin outer coat and a light red-brown inner coat loose and fibrous on the outer surface and closely investing the thin light brown testa of the seed, which is covered at the base by the numerous pale radiating branches of the star-like raphe.

In Florida *Oreodoxa regia* inhabits hummocks on Rogue's River, about twenty miles east of Caximbas Bay, Long's Key off the southern coast, and the shores of Bay Biscayne, near the mouth of Little River.[1] It is common in Cuba and other West Indian islands, and in Central America.

[1] *Garden and Forest*, ix. 152, f. 21.

The wood of the interior of the stem is spongy, pale brown, and much lighter than the hard heavy exterior rim, which contains numerous dark conspicuous fibro-vascular bundles. The specific gravity of the absolutely dry wood of the exterior of the stem is 0.7982, a cubic foot weighing 49.73 pounds, the specific gravity of the interior being only 0.2128. The outer rim is sometimes manufactured into canes, its hardness and strength and the beauty of the markings caused by the dark-colored fibro-vascular bundles adapting it for this use.

The name of the person who discovered *Oreodoxa regia* in the United States is not known.[1] In Cuba it is often planted to form avenues, for which purpose its tall slender pale columnar stems and noble heads of foliage make it particularly valuable. It was cultivated in Europe as early as 1836,[2] and now graces the gardens of all tropical countries.[3]

[1] Nuttall, in his preface to *The Sylva of North America* (p. viii.), states that he was informed of the existence of a Palm ninety feet high growing at some distance from the coast in east Florida. This Palm must have been *Oreodoxa regia*. It was seen by Dr. J. G. Cooper, in 1859, on the shores of Bay Biscayne, where Dr. A. P. Garber subsequently collected it, and its existence on Rogue's River and Long's Key was established by Mr. A. H. Curtiss.

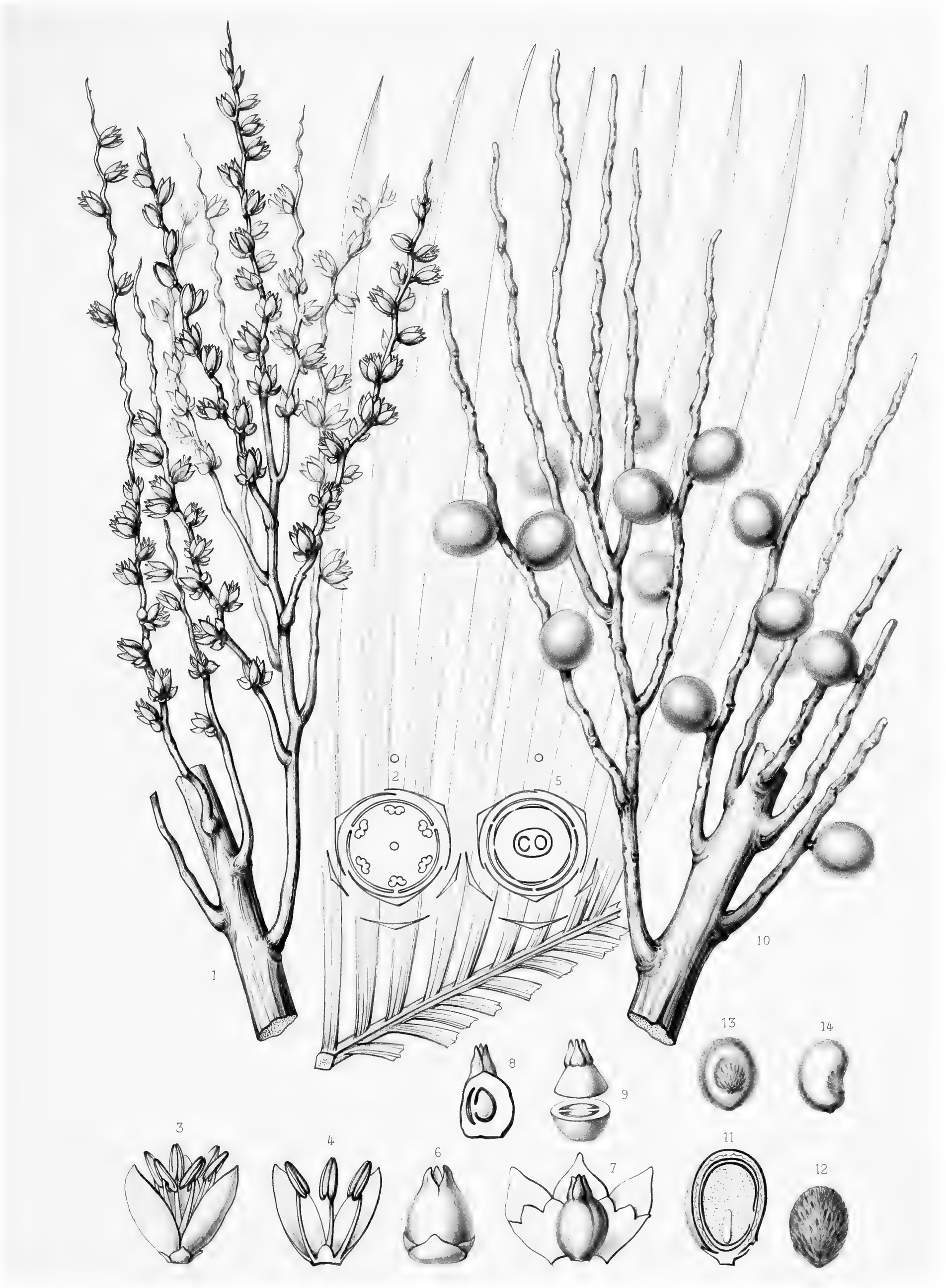
[2] H. Wendland, *Index Palmarum*, 31.

[3] *Gard. Chron.* n. ser. iv. 302, f. 66. — Massart, *Bull. Soc. Bot. Belg.* xxxiv. 159, f. 3.

EXPLANATION OF THE PLATE.

Plate DV. Oreodoxa regia.

1. Portion of a flowering spadix, natural size.
2. Diagram of a staminate flower.
3. A staminate flower, enlarged.
4. Vertical section of a staminate flower, enlarged.
5. Diagram of a pistillate flower.
6. A pistillate flower, enlarged.
7. A pistillate flower, the perianth displayed, enlarged.
8. Vertical section of a pistil, enlarged.
9. A pistil divided transversely, enlarged.
10. Portion of a fruiting spadix, natural size.
11. Vertical section of a fruit, enlarged.
12. A nutlet, enlarged.
13. A seed, basal view.
14. A seed, lateral view.
15. Portion of a leaf, much reduced.



C.F. Faxon del. *Migneaux sc.*

OREODOXA REGIA, Mart.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

PSEUDOPHŒNIX.

FLOWERS monœcious; calyx of the pistillate flower cupular, 3-toothed; petals 3, ovate, acute; staminodia 6. Fruit drupaceous, 1 to 3-lobed. Spadix compound, interfoliar. Leaves alternate, pinnatifid.

Pseudophœnix, H. Wendland, *Garden and Forest*, i. 352 (1888). — Drude, *Engler & Prantl Pflanzenfam.* ii. pt. iii. 64. — Baillon, *Hist. Pl.* xiii. 381.

A tree, with an endogenous stem abruptly enlarged at the base, cylindrical, or tapering gradually from the middle to both ends, conspicuously marked at distances of five or six inches by the narrow ring-like dark scars left by the falling of the petioles, and thin pale blue or nearly white rind about one sixteenth of an inch in thickness. Leaves abruptly pinnatifid, terminal, alternate, erect and arching; pinnæ numerous, crowded, linear-lanceolate, acuminate, increasing in length and width from the ends of the leaf to the middle, springing from the rachis at acute angles, and pointing toward the apex of the leaf, convex and bright green on the upper side, concave and glaucous on the lower, folded together at the base, thick and firm in texture, with thickened pale margins, inserted obliquely on the sides of the rachis near its top, toward the base of the leaf in deep grooves and above the middle on its slightly rounded sides; rachises near the base of the leaf convex below, and concave above, with thin margins, gradually decreasing in width upward, and toward the apex of the leaf flat and narrow below and acute above, marked on the sides at the base of the pinnæ, with dark conspicuous gland-like excrescences; petioles short, concave above, with thin entire margins separating sparingly into slender fibres, convex below, gradually enlarged at the base into broad thick vaginas composed of stout pale longitudinal brittle fibres. Spadix interfoliar, compound, pendulous, pedunculate, glabrous, light yellow-green, much shorter than the leaves, its primary branches spreading from the stem nearly at right angles, slightly zigzag, stout and much flattened toward the base, slender and terete above the middle, secondary branches slightly compressed below, and furnished at the base on the upper side with a thickened ear-like body; ultimate branches short, rigid, spreading at right angles, densely flowered. Spathes and flowers unknown. Fruit drupaceous, globose, or two or three-lobed by the development of the second and third carpels, marked on the side near the base or centrally when the fruit is lobed with the remnants of the style, surrounded below by the withered obscurely three-lobed calyx, the ovate-oblong reflexed petals rounded or acute, thickened and apiculate at the apex, as long as the peduncle, and the six slender spreading staminodia tipped with minute acute abortive anthers, pedunculate, the peduncle slender, abruptly enlarged at the bottom, articulate from a persistent cushion-like body apiculate in the centre, its point penetrating a cavity in the base of the peduncle; epicarp coriaceous, bright orange-scarlet; mesocarp grumose, adherent to the thin crustaceous brittle dark orange-brown endocarp. Seed subglobose, free, erect; hilum basal, slightly depressed; testa very thin, light red-brown marked with the pale conspicuous ascending two or three-branched raphe, closely investing the horny white uniform albumen. Embryo minute, basilar.

The wood of Pseudophœnix is soft and light, with a thin solid outer rim and numerous large dark-colored conspicuous fibro-vascular bundles. It decays as soon as it is cut. It has not been examined scientifically.

Pseudophœnix inhabits Elliott's Key, where it was discovered on April 19, 1886,[1] and Key Largo, Florida.

[1] Early on the morning of April 19, 1886, A. H. Curtiss, C. E. Faxon, and C. S. Sargent landed from the United States Light-house Steamer Laurel at Mr. Henry Filer's plantation near the eastern end of Elliott's Key, and found Pseudophœnix growing on

The genus, which owes its name to its fancied resemblance to Phœnix, belongs to another tribe, probably the Chamædoræ. It is represented by a single species.

the border of a field which had recently been cleared for the cultivation of Pineapples.

The first account of the genus without characters, based on a letter from Dr. Hermann Wendland, to whom its discovery had been communicated, appeared in November, 1886, in *The Botanical Gazette* (xi. 314), and was afterward substantially reproduced by André in the *Revue Horticole* (1887, 34); and also in the *Bullettino della Società R. Toscana di Orticultura* (xii. 64). In 1889 Sprenger published a popular description, without characters, of this Palm under the name of *Sargentia Aricocca* in the *Bullettino della Società R. Toscana di Orticultura* (xiv. 341).

PSEUDOPHŒNIX SARGENTI.

Pseudophœnix Sargenti, H. Wendland, *Garden and Forest*, i. 352, f. 55, 56 (1888). — *Gard. Chron.* ser. 3, iv. 408, f. 56. — André, *Rev. Hort.* 1888, 482, 574, f. 140, 141.

A tree, from twenty to twenty-five feet in height, with a trunk twelve or fifteen feet long and ten or twelve inches in diameter. The leaves are five or six feet in length, with pinnæ often eighteen inches long and an inch wide near the middle of the leaf, and at its extremities six or eight inches long and from one third to one half of an inch wide, rachises an inch wide at the base, and petioles six or eight inches in length. The spadix is three feet long and two and a half feet wide, and, as the fruit ripens in May and June, probably appears in the autumn. The fruit, which is showy in color, is from one half to three quarters of an inch across, and is raised on a peduncle a quarter of an inch long. The seed is a quarter of an inch in diameter.

Pseudophœnix Sargenti inhabits the east end of Elliott's Key, Florida, where there are a few individuals; and in sandy soil mingled with *Reynosia latifolia* and *Pisonia obtusata*, on the eastern end of Key Largo, a short distance from the southern shore, it forms a grove containing about two hundred plants, varying from seedlings two or three feet high to full-grown trees.

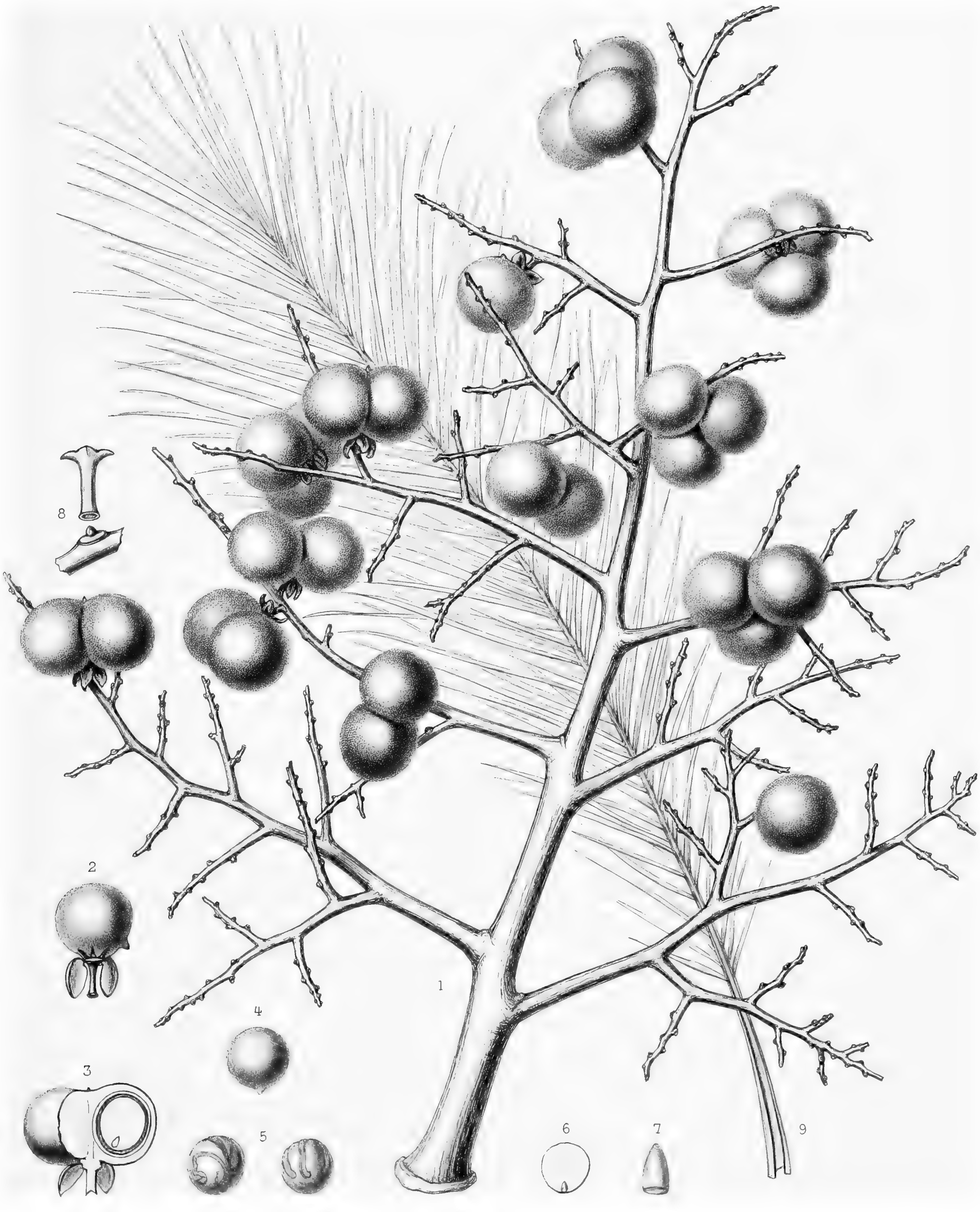
Attempts have been made to transfer young plants from the grove on Key Largo[1] into gardens, but they have not yet proved particularly successful, and unless *Pseudophœnix Sargenti* also inhabits some of the Bahama Islands, as is not improbable, it seems destined to speedy extermination.

[1] Curtiss, *Garden and Forest*, i. 279.

EXPLANATION OF THE PLATE.

PLATE DVI. PSEUDOPHŒNIX SARGENTI.

1. A branch of a fruiting panicle, natural size.
2. A 1-seeded fruit, with subbasal lateral style and remnants of the flower, one of the petals removed, natural size.
3. Vertical section of a 3-lobed fruit, natural size.
4. A stone, natural size.
5. A seed, lateral views, showing the branching raphe, natural size.
6. Vertical section of a seed, natural size.
7. An embryo, much magnified.
8. A calyx, and peduncle showing its articulation, enlarged.
9. A leaf, much reduced.



C.E. Faxon del. Rapine sc.

PSEUDOPHŒNIX SARGENTI, Wendl.

A. Riocreux direx.t Imp. J. Taneur, Paris.

SABAL.

Flowers perfect; calyx cupular, unequally 3-lobed; corolla 3-lobed; stamens 6, dilated and united at the base; ovary superior, 3-celled; ovules basilar, erect. Fruit baccate, globose, or 2 or 3-lobed. Spadix short or elongated, compound, interfoliar. Leaves alternate, flabellate, orbicular, or cuneate at the base, petiolate, the petioles unarmed.

Sabal, Adanson, *Fam. Pl.* ii. 495 (1763). — Endlicher, *Gen.* 253. — Meisner, *Gen.* 357. — Bentham & Hooker, *Gen.* iii. 922. — Drude, *Engler & Prantl Pflanzenfam.* ii. pt. iii. 37. — Baillon, *Hist. Pl.* xiii. 313.

Unarmed trees or shrubs, with columnar and often stout or short annulated endogenous stems ascending while young from a subterranean thickened descending clavate caudex, clothed above for many years with the remnants of the sheathing bases of the petioles of the fallen leaves, and below with light red-brown rind, and long stout tough roots, which ultimately often form a great densely matted ball at the base of a short underground stem. Leaves terminal, induplicate in vernation, alternate, flabellate, orbicular, or cuneate at the base, tough and coriaceous, divided from the apex deeply or slightly into many narrow two-parted long-pointed segments plicately folded at the base, inserted obliquely on the sides of the rachis, often filamentose on the thickened margins, with narrow midribs prominent below, and numerous slender straight veins; rachises on the lower surface rounded and broadly winged toward the base, nearly flat and wingless toward the apex, and gradually narrowed to above the middle of the blade of the leaf, thin and acute on the upper surface; ligulas adnate to the rachises, short or elongated, acute, concave, with thin incurved entire margins; petioles rounded on the back, biconcave with a central ridge on the upper side toward the apex, their margins acute, unarmed, concave and enlarged at the base into elongated chestnut-brown lustrous vaginas of stout tough fibres; juvenile leaves lanceolate to oblong-lanceolate, gradually narrowed into slender petioles, entire. Spadix axillary, pedunculate, elongated, decompound, at first erect, its rachis compressed and flattened horizontally; primary branches short and pendulous or decurved, angled or compressed, bearing numerous slender densely flowered secondary branches in the axils of ovate apiculate scarious persistent bracts; spathes numerous, the outer acuminate, inclosing the spadix in the bud, persistent on its peduncle, becoming hard and woody at maturity; the second tubular, conspicuously veined, thick and firm in texture, scarious and oblique at the apex, prolonged on the lower side into a long narrow point, infolding the base of the rachis, each branch with its short thin spathe and the node of the rachis below it inclosed in a smaller although otherwise similar spathe. Flowers perfect, minute, glabrous, white or greenish white, solitary on the ultimate branches of the spadix, bibracteolate, in the axils of minute ovate acute persistent bracts. Calyx tubular, truncate at the base, unequally three-lobed, the lobes slightly imbricated in æstivation, acute. Corolla deeply three-lobed, narrowed at the base into a short tube, the lobes ovate-oblong, concave, acute, in the bud slightly imbricated below, valvate at the apex. Stamens six, those opposite the petals rather longer than the others; filaments white, subulate, dilated at the base, united into a shallow cup adnate to the tube of the corolla; anthers ovate, acute, bright yellow, attached on the back, introrse, two-celled, the cells free and spreading at the base, opening longitudinally. Ovary superior, sessile, composed of three carpels, three-lobed, three-celled, gradually narrowed into an elongated three-lobed columnar style, truncate and stigmatic at the apex, becoming subbasilar on the fruit; ovule solitary in each cell, basilar, erect, semianatropous; micropyle superior, extrorse. Fruit small, baccate, globose, or obovate and gradually narrowed below, black and

rather lustrous, one or rarely two or three-lobed, raised on a short stout stem adjacent to the remnants of the style; pericarp separable into three coats, the outer thin, sweet, and fleshy, mesocarp dry and spongy, closely investing the membranaceous inner coat lustrous on the inner surface. Seed depressed-globose, free, erect, marked on the side by the prominent micropyle, depressed near the minute basal light-colored hilum by a shallow pit rugose on the margins; testa thin, light or dark chestnut-brown, and lustrous; raphe ventral, its branches obsolete; albumen uniform, horny, penetrated by a broad shallow basal cavity filled by the thickening of the testa. Embryo minute, dorsal.[1]

Sabal is confined to the New World, where it is distributed from the Bermuda Islands and the south Atlantic and Gulf coasts of North America through the West Indies to Venezuela.[2] Of the seven species which are now distinguished, four inhabit the United States; two of these are trees, and the others are acaulescent.[3] The type has survived from the period when Palm-trees abounded in North America and Europe, and traces of its ancestors have been found in the lower eocene of western Europe and in the lignitic formations of Colorado; during the lower miocene period a large Sabal-like tree inhabited Europe as far north as 55 degrees, and existed in Italy until the later miocene.[4]

The large succulent leaf-buds of the arborescent species are cooked and eaten as a vegetable, although their removal kills the trees. Coarse hats, mats, and baskets are manufactured from the leaves, which also afford durable thatch for the roofs of buildings. Pieces of the spongy part of the stem are used as a substitute for scrubbing-brushes, and in the southern United States brushes are made with the stout strong fibres of the sheaths of the leaf-stalks.

In North America dangerous insect enemies are unknown to Sabal, and it does not suffer seriously from fungal diseases.[5]

The generic name is of uncertain origin.

[1] In germinating, the apex of the cotyledon is transformed into a spongy body, through which the albumen is absorbed, and the thick conical caulicle penetrates the pericarp of the fruit, carrying with it the plumule inclosed in the free cylindrical base of the cotyledon and descends two or three inches into the ground. From the interior part of the base of the cotyledon a protuberance is developed, which grows rapidly toward the surface, and is at last ruptured by the plumule, around which it forms a cylindrical sheath. The first leaf, which is alternate with the cotyledon, is white and scale-like, and incloses the base of the second leaf; this, like the others formed during the first year, is lanceolate and entire. The caulicle withers, and disappears usually soon after the appearance of the second leaf, and a thick conical body appears at the base of the plumule, which, descending into the ground, forms a thickened club-shaped yellow caudex marked by the scars of fallen leaves, furnished with numerous slender tough roots, and closely pressed against the ascending axis of the plant. (For the germination of Sabal, see Martius, *Hist. Nat. Palm.* i. t. Z ii. f. 3. — Micheels, *Recherches sur les Jeunes Palmiers*, 59, t. 1, f. 2; Holm, *Mem. Torrey Bot. Club*, ii. 76, t. xiii. f. 84, 86.)

[2] Martius, *l. c.* iii. 245. — Kunth, *Enum.* iii. 245. — Karsten, *Fl. Colomb.* ii. 137 (Trithrinax). — Grisebach, *Fl. Brit. W. Ind.* 514.

[3] *Sabal glabra.*

Chamærops glabra, Miller, *Dict.* ed. 8, No. 2 (1768).

Corypha minor, Jacquin, *Hort. Vind.* iii. 8, t. 8 (1776). — Murray, *Syst. Veg.* ed. 14, 984. — Lamarck, *Dict.* ii. 131.

Corypha pumila, Walter, *Fl. Car.* 119 (1788).

Chamærops acaulis, Michaux, *Fl. Bor.-Am.* i. 207 (1803). — Shecut, *Fl. Car.* i. 383.

Sabal Adansoni, Guersent, *Bull. Soc. Philom.* iii. 206, t. 25 (1803). — *Bot. Mag.* xxxv. t. 1434. — Trattinick, *Archiv.* t. 362, 362ª. — Pursh, *Fl. Am. Sept.* i. 239. — Nuttall, *Gen.* i. 230. — Roemer & Schultes, *Syst.* vii. pt. ii. 1485. — Croom, *Am. Jour. Sci.* xxvi. 315. — Martius, *l. c.* iii. 246, t. 103, f. 2, i. t. Y, f. 4. — Dietrich, *Syn.* ii. 1201. — Kunth, *l. c.* iii. 246. — Chapman, *Fl.* 438. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 65.

Rhapis acaulis, Willdenow, *Spec.* iv. pt. ii. 1093 (1805). — Aiton, *Hort. Kew.* ed. 2, v. 474.

Sabal minor, Persoon, *Syn.* i. 399 (1805). — Sprengel, *Syst.* ii. 137.

Sabal pumila, Elliott, *Sk.* i. 430 (1817).

Sabal glabra is a low plant of the southern coast region of the United States, with a short subterranean stem, glaucous fan-shaped, slightly pinnatifid leaves nearly circular in outline, an erect spadix much longer than the leaves, and small fruit.

The second shrubby species, *Sabal Etonia*, Nash (*Bull. Torrey Bot. Club*, xxiii. 99 [1896]) is distinguished by its elongated contorted root-stalk, small thin orbicular deeply cleft leaves, short spadix, and large fruit.

[4] Lesquereux, *Rep. U. S. Geolog. Surv.* vii. 112, t. 11, f. 3, 3ª, t. 12, f. 1, 2. — Saporta, *Origine Paléontologique des Arbres*, 118. — Zittel, *Handb. Palæontolog.* ii. 372.

[5] The most interesting fungi botanically which attack the Palms in this country are species of Graphiola which belong to a genus usually placed in the order of Smuts, although in certain peculiarities they differ considerably from the typical members of the order; they form small black powdery tufts or cups sparsely scattered over the surface of the leaves, *Graphiola congesta*, Berkeley & Ravenel, attacking the leaves of *Sabal Palmetto*.

In the tropics the leaves of Palms are frequently covered with a sooty black growth, caused by different species of Meliola, of which two species, *Meliola palmicola*, Winter, and *Meliola furcata*, Léveillé, are found on Sabal in North America. In addition to these, *Sphærella sabaligena*, Ellis & Everhart, *Venturia sabalicola*, Ellis & Everhart, *Helminthosporium Palmetto*, Gerard, and *Phyllosticta Palmetto*, Ellis & Everhart, have been noticed on the leaves of *Sabal Palmetto*.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

Spadix short.

Fruit subglobose, 1-celled; seed-coat light bright chestnut-color . . . . . 1. S. PALMETTO.

Spadix elongated.

Fruit often 2 or 3-lobed, with 2 or 3 seeds; seed-coat dark chestnut-brown . . . . . 2. S. MEXICANA.

SABAL PALMETTO.

Cabbage Tree. Cabbage Palmetto.

SPADIX short. Fruit subglobose, 1-celled; seed-coat light bright chestnut-color.

Sabal Palmetto, Roemer & Schultes, *Syst.* vii. pt. ii. 1487 (1830). — Martius, *Hist. Nat. Palm.* iii. 247. — Dietrich, *Syn.* ii. 1201. — Kunth, *Enum.* iii. 247. — Spach, *Hist. Vég.* xii. 107. — Chapman, *Fl.* 438. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 64. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 217. — Nash, *Bull. Torrey Bot. Club*, xxiii. 99.

Corypha Palmetto, Walter, *Fl. Car.* 119 (1788).

Chamærops Palmetto, Michaux, *Fl. Bor.-Am.* i. 206 (1803). — Willdenow, *Spec.* iv. pt. ii. 1158. — Michaux, f. *Hist. Arb. Am.* ii. 186, t. 10. — Pursh, *Fl. Am. Sept.* i. 240. — Nuttall, *Gen.* i. 231. — Elliott, *Sk.* i. 431. — Sprengel, *Syst.* ii. 137. — Croom, *Am. Jour. Sci.* xxvi. 315. — Loudon, *Arb. Brit.* iv. 2532.

A tree, with a trunk often thirty or forty feet in height and two feet in diameter, broken by shallow irregular interrupted fissures into broad ridges, with a short pointed knob-like caudex surrounded by a dense mass of contorted roots, often four or five feet in diameter and five or six feet deep, from which tough light orange-colored roots, often nearly half an inch in diameter, covered with thick loose rind easily broken into narrow fibres, and furnished with short slender brittle rootlets, penetrate the soil for a distance of fifteen or twenty feet, and crowned with a broad head of leaves which are at first upright, then spread nearly at right angles with the stem, and are finally pendulous. They are wedge-shaped at the base and broad at the apex, which is recurved and deeply divided into narrow two-parted segments, with thin pale margins which separate into long slender threads, and thin light orange-colored midribs; they are thick and firm, dark green and lustrous, five or six feet long and seven or eight feet broad, and are borne on petioles six or seven feet in length and an inch and a half wide at the apex, the ligula being about four inches in length. The spadix is from two to two and a half feet long, with slender incurved branches, thin ultimate divisions, and thin secondary spathes flushed with red at the apex and conspicuously marked by pale slender longitudinal veins. The flowers, which are produced in the axils of minute deciduous acute bracts much shorter than the perianth, open in June, and are nearly a quarter of an inch across. The fruit, which ripens late in the autumn, is subglobose or slightly obovate, and gradually narrowed at the base, black and lustrous, one-seeded, raised on a short stout peduncle, and about a third of an inch in diameter, with rather thick sweet dry flesh. The seed is a quarter of an inch broad, with a light bright chestnut-colored coat and a small micropyle.

Sabal Palmetto inhabits sandy soil in the immediate neighborhood of the coast, and is distributed from Smith's Island at the mouth of the Cape Fear River, North Carolina, to Key Largo, Florida, and along the Gulf coast to the mouth of the Appalachicola River. Often forming groves of considerable extent on the Atlantic coast, it is most abundant and grows to its largest size on the west coast of the Florida peninsula south of Cedar Keys.[1]

The wood of *Sabal Palmetto* is light, soft, and pale brown in color, and contains numerous hard fibro-vascular bundles which make it difficult to work, the outer rim of the stem, about two inches in thickness, being much lighter and softer. The specific gravity of the absolutely dry wood is 0.4404, a cubic foot weighing 27.45 pounds. In the southern states the trunks are used for wharf-piles; polished cross sections of the stem sometimes serve for the tops of small tables, and the wood is largely manufactured into canes. From the sheaths of young leaves the bristles of scrubbing-brushes are made in Florida in considerable quantities.[2]

1 Wilson, *Forest Leaves*, iii. 53, f.

2 To obtain the fibre used in the manufacture of the coarse scrubbing-brushes now often used in the United States, three or four feet of the top of the tree, "the bud," as it is technically called,

The earliest description of *Sabal Palmetto* appears in Catesby's *Hortus Britano-Americanus*, published in 1763.[1] According to Aiton,[2] it was not introduced into English gardens until 1809, and, although occasionally cultivated in the cities of the south Atlantic states, it is still exceedingly rare in gardens.[3]

The survival of *Sabal Palmetto*, with its tall columnar trunk and broad crown of foliage, the most boreal of existing Palm-trees in a region where the flora is northern in its predominating types, gives special interest to the coast of the southeastern United States, where it is the most conspicuous feature of the vegetation.[4]

consisting of the closely imbricated young leaf-stalks, is cut off and trimmed down to a diameter of about eight inches. In this form the bud is received at the factory, where the soft edible core, consisting of the youngest leaves, is removed, leaving a cylinder with walls about three inches in thickness. This is boiled and shredded by machinery specially devised for the purpose, and when the fibre is dried, it is ready for the brush-maker. One factory in Jacksonville, Florida, uses weekly 7,500 buds obtained principally from the west coast of the peninsula. As only young and healthy trees are used, and as the removal of the bud kills the tree, the industry is a wasteful and expensive one, destined to exterminate the Palmetto; and its existence is also threatened by the use for culinary purposes of the cabbage, or terminal bud, which is considered a great delicacy by the negroes of the southern states.

[1] *Palma Brasiliensis prunifera folio plicatili seu flabelli forma caudice squammato*, 40.

[2] Aiton, *Hort. Kew.* ed. 2, v. 490.

[3] It is remarkable that *Sabal Palmetto*, which might be expected to be the hardiest of all arborescent Palms, has remained so rare in gardens. A plant has long been cultivated in the Palm House of the Royal Gardens at Kew, in England, and the species is said to be established in Ceylon. In California, where nearly all the Palms of temperate regions grow vigorously, it has not proved a success; and it appears to be unknown in the gardens of southern France and the Riviera, although it is said to flourish in those of southern Italy. (See Sprenger, *Bull. Soc. Tosc. Ort.* xiv. 318. See, also, *Garden and Forest*, ii. 136; v. 158, 215.)

[4] On June 28, 1776, a force of less than one hundred Carolinians, under command of Moultrie, protected by the rude fortification on Sullivan's Island in Charleston Harbor, made of the trunks of the Palmetto, repulsed the attack of a British fleet under command of Sir Peter Parker, and when the state of South Carolina was organized, the state seal, which was first used in May, 1777, was made to commemorate this victory. A Palm-tree growing erect on the seashore represents the strength of the fort, while at its base an Oak-tree torn from the ground and deprived of its branches recalls the British fleet built of oak timber overcome by the Palmetto. (See John Drayton, *Memoirs of the American Revolution*, ii. 372.)

EXPLANATION OF THE PLATE.

Plate DVII. Sabal Palmetto.

1. Portion of a flowering spadix, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. Vertical section of a flower, enlarged.
5. A corolla, with stamens displayed, enlarged.
6. A pistil, enlarged.
7. Portion of a fruiting spadix, natural size.
8. Vertical section of a fruit, enlarged.
9. A seed, enlarged.
10. An embryo, much magnified.
11. A leaf, upper surface, much reduced.
12. Diagram of a section of one of the divisions of a leaf.
13. A seedling, natural size.

C.E.Faxon del. *Lövendal sc.*

SABAL PALMETTO, R.x S.

A.Riocreux direx.t *Imp. J. Tancur, Paris.*

SABAL MEXICANA.

Palmetto.

SPADIX elongated. Fruit often 2 or 3-lobed, with 2 or 3 seeds; seed-coat dark chestnut-brown.

Sabal Mexicana, Martius, *Hist. Nat. Palm.* iii. 246, i. t. S, f. 2–7, t. 5, f. 4 (1833–50). — Kunth, *Enum.* iii. 246. — Hemsley, *Bot. Biol. Am. Cent.* iii. 410. — Sprenger, *Bull. Soc. Tosc. Ort.* xiv. 317. — Watson, *Proc. Am. Acad.* xxv. 135.

Chamærops Palmetto, Schott, *Mex. Bound. Surv.* i. pt. ii. 44 (not Michaux) (1857).

Sabal Palmetto (?), Havard, *Proc. U. S. Nat. Mus.* viii. 524 (not Roemer & Schultes) (1885). — Coulter, *Contrib. U. S. Nat. Herb.* ii. 452 (*Man. Pl. W. Texas*).

A tree, with a trunk from thirty to fifty feet in height and often two and a half feet in diameter, marked with distinct rings, and covered below with bright reddish brown rind and above with the wide persistent sheaths of the leaf-stalks. The leaves are cuneate below, dark yellow-green and lustrous, five or six feet long, often seven feet wide, and divided nearly to the middle into two-parted segments, which are about two inches wide, with thickened pale margins separating into long thin threads; they are borne on petioles seven or eight feet in length and an inch and a half wide at the apex, the ligulas being about six inches long; erect when they first unfold, they gradually spread at right angles to the stem and finally become pendulous. The flowers, which in Texas appear late in March or early in April, are borne in the axils of the acute scarious persistent bracts half as long as the perianth on the stout elongated simple or rarely branched secondary branches of a spadix which is seven or eight feet in length, with stout ultimate divisions. The fruit ripens early in the summer and is about half an inch in diameter, with thin dry flesh, and globose or often two or three-lobed by the development of the second and third carpels. The seed, which is nearly half an inch broad and about a quarter of an inch high, is very dark chestnut-brown, with a broad shallow basal cavity and a conspicuous orange-colored hilum, and is marked on the side with the prominent micropyle.

In Texas, where it was first detected about seventy years ago by the Belgian botanist Berlandier,[1] *Sabal Mexicana* grows in the rich soil of the bottom-lands of the Rio Grande from the neighborhood of Edinburgh nearly to the Gulf, with *Ulmus crassifolia*, *Acacia Berlandieri Fraxinus Berlandieriana*, *Leucæna pulverulenta*, and *Erythrina herbacea;* and below the Rio Grande it ranges southward in the neighborhood of the coast to southern Mexico.

The wood of *Sabal Mexicana* is exceedingly light, soft, and pale brown tinged with red, and contains thick light-colored rather inconspicuous fibro-vascular bundles, the outer rim, about an inch in thickness, being softer and rather lighter colored. The specific gravity of the absolutely dry wood is 0.2607, a cubic foot weighing 16.25 pounds.[2]

On the Gulf coast the trunks of *Sabal Mexicana* are used for wharf-piles, and on the lower Rio Grande its leaves are cut almost as fast as they appear to supply thatch for houses. In southern Mexico it is cultivated to produce leaves which are manufactured into hats.[3] In Brownsville, Matamoras, and other towns on the lower Rio Grande, *Sabal Mexicana* is frequently planted as a street tree, and in some of the gardens of Monterey noble old specimens exist.

[1] See i. 82.

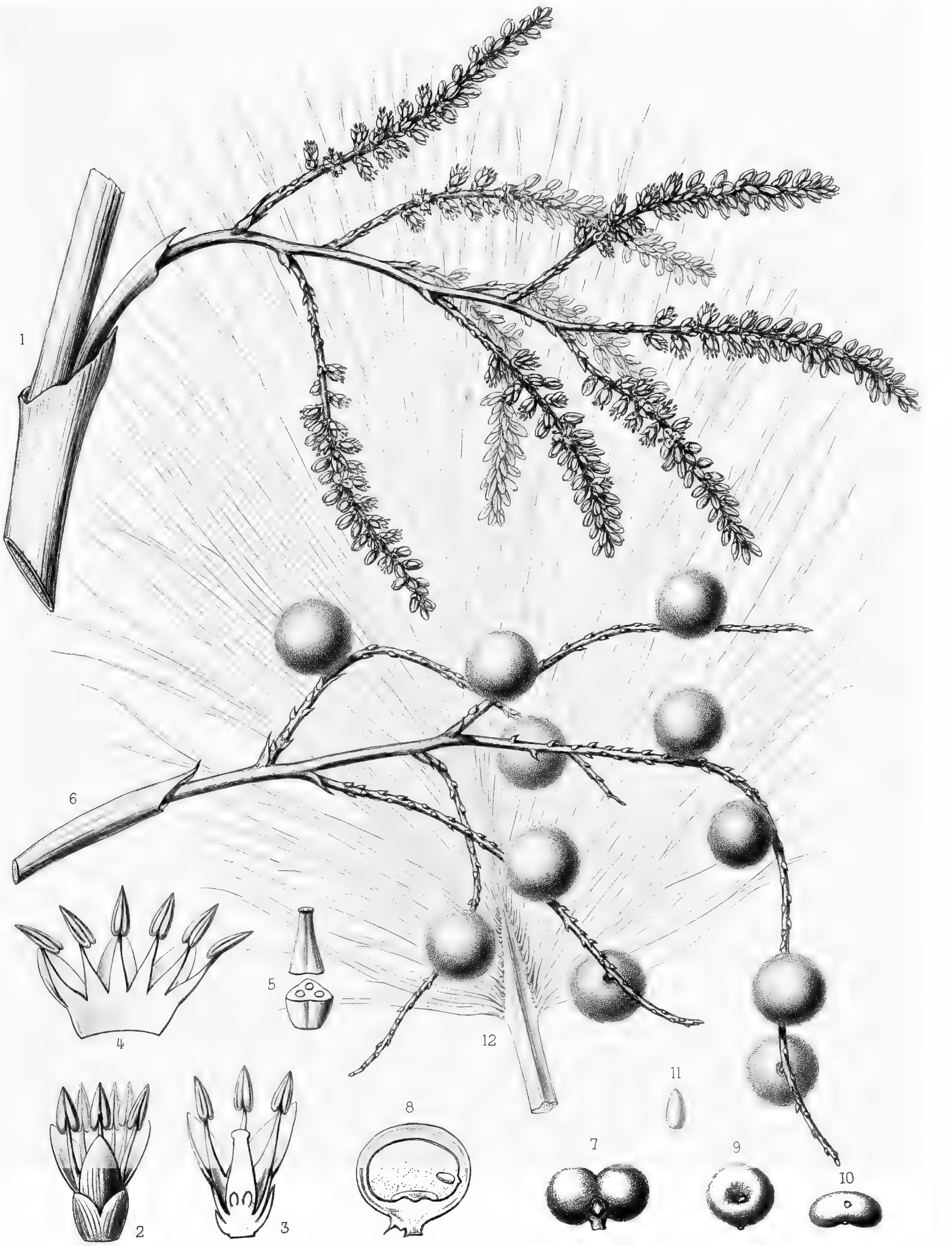
[2] *Garden and Forest*, iii. 356.

[3] Heller, *Bonplandia*, ii. 157.

EXPLANATION OF THE PLATE.

PLATE DVIII. SABAL MEXICANA.

1. Portion of a flowering panicle.
2. A flower, enlarged.
3. Vertical section of a flower, enlarged.
4. Perianth of a flower, with stamens displayed, enlarged.
5. A pistil divided transversely, enlarged.
6. Portion of a fruiting panicle, natural size.
7. A 2-lobed fruit, showing a third abortive lobe, natural size.
8. Vertical section of a fruit, enlarged.
9. A seed, basal view, natural size.
10. A seed, lateral view, with micropyle, natural size.
11. An embryo, much magnified.
12. A leaf, much reduced.



C. E. Faxon del. Rapine sc.

SABAL MEXICANA, Mart.

A. Riocreux direx.t Imp. J. Taneur, Paris.

WASHINGTONIA.

FLOWERS perfect; calyx tubular, slightly 3-lobed; corolla funnel-formed, 3-lobed; stamens 6; ovary superior, 3-celled; ovule solitary, erect. Fruit baccate, ellipsoidal, 1-celled. Spadix elongated, compound, interfoliar. Leaves alternate, flabellate, orbicular, long-petioled; petioles spinose on the margins.

Washingtonia, H. Wendland, *Bot. Zeit.* xxxvii. 68 (1879). — Bentham & Hooker, *Gen.* iii. 923.
Pritchardia, Drude, *Engler & Prantl Pflanzenfam.* ii. pt. iii. 35 (in part) (1889). — Baillon, *Hist. Pl.* xiii. 319 (in part).

Trees, with stout columnar endogenous trunks covered below with thick pale rind and above with the persistent sheaths of many dead leaves, long tough roots, and a broad terminal crown of erect, then spreading, and ultimately pendulous leaves. Leaves induplicate in vernation, alternate, flabellate, orbicular, divided nearly to the middle into many narrow deeply two-cleft recurved segments, separating on the margins into numerous slender pale fibres, long-petiolate; those of the first year linear-lanceolate; rachises short, slightly rounded on the back, gradually contracted from a broad base, their margins concave, and furnished below with narrow erect wings, slender and acute above; ligulas oblong, elongated, thin, broad and conspicuously laciniate at the apex; petioles broad and thin, plano-convex or slightly concave on the upper side, rounded on the lower, armed irregularly with broad thin large and small, straight or hooked spines confluent into a thin bright orange-colored cartilaginous margin, gradually enlarged at the base into the thick elongated broad concave light bright chestnut-brown vaginas composed of a network of thin strong fibres. Spadix interfoliar, paniculate, elongated, pedunculate, glabrous, its numerous branches flexuose and pendulous; spathes numerous, narrow, elongated, glabrous. Flowers minute, white, articulate on thickened disk-like pedicels in the axils of ovate acute scarious bracts, slender and acuminate before anthesis. Calyx tubular, indurate at the base, gradually enlarged and slightly three-lobed at the apex, scarious, persistent under the fruit, the lobes retuse, scarious, erose, imbricated in æstivation. Corolla funnel-formed, the fleshy tube included in the calyx, half as long as the lanceolate acute striate lobes thickened and glandular on the inner surface at the base, reflexed, imbricated in æstivation, deciduous. Stamens six, inserted on the throat of the corolla; filaments free and flattened below, much thickened near the middle, slender and terete toward the apex, exserted; anthers linear-oblong, attached on the back, versatile, pale yellow, two-celled, the cells spreading below, opening longitudinally. Ovary superior, sessile on a thin disk, depressed-obovoid, three-lobed, three-celled, crowned by an elongated flexuose exserted white horny style stigmatic at the apex; ovule solitary in each cell, lateral, erect, anatropous. Fruit baccate, small, ellipsoidal, one-celled, one-seeded, short-stalked, crowned with the remnants of the abortive carpels and of the style; pericarp of two coats, the outer thin, dry, black, and fleshy, the inner membranaceous dark orange-colored, lustrous on the inner surface. Seed free, erect, oblong-ovate, convex above, the base flat, depressed in the centre, marked by the minute sublateral hilum and the broad conspicuous raphe; micropyle lateral, minute; testa thin, light chestnut-brown, closely investing the uniform horny albumen. Embryo minute, lateral, the radicle turned toward the base of the fruit.

Two species of Washingtonia are known; one inhabits the interior desert region of southern California and the adjacent part of Lower California, and the second[1] the mountain cañons of western Sonora and southern Lower California.

[1] *Washingtonia Sonoræ*, Watson, *Proc. Am. Acad.* xxiv. 79 (1889); xxv. 136. First collected by Dr. Edward Palmer in 1887 in secluded cañons of the mountains about Guaymas and subsequently at La

The fruit is eaten by Indians.

The genus is dedicated to George Washington.

Paz, Lower California, *Washingtonia Sonoræ*, which is still very imperfectly known, is described as a tree twenty-five feet in height, with a trunk a foot in diameter, and glaucous filiferous leaves three or four feet in diameter, borne on comparatively slender petioles beset on the margins with variously curved spines, connected by a web of floccose hairs. The spadix is shorter, more slender, and more sparingly branched, and the perianth is thinner and more scarious than those of *Washingtonia filamentosa*. The seeds, which are flattened-globose, and about an eighth of an inch long, are used by the Indians of Lower California as food.

Another species, *Washingtonia robusta*, has been described (H. Wendland, *Berlin. Gartenzeit.* ii. 198 (1883). — André, *Rev. Hort.* 1885, 401, f. 73; 1895, 155. — Watson, *Proc. Am. Acad.* xxv. 136. — S. B. Parish, *Garden and Forest*, iii. 52, 542; *Zoë*, iv. 350. — Orcutt, *W. Am. Scientist*, i. 63, 76). *Washingtonia robusta* appeared about 1869, in Linden's nursery in Ghent, among a number of plants of *Washingtonia filamentosa* which were raised from seed believed to have been obtained from Lower California, and may be a seminal form of this species, as is now usually believed, or more probably a species from Lower California still unknown in a wild state. In gardens, where it has not flowered, *Washingtonia robusta* is a more vigorous and more rapid-growing plant than *Washingtonia filamentosa*, and its darker green and more lustrous leaves on shorter petioles give it a more robust appearance.

WASHINGTONIA FILAMENTOSA.

Desert Palm. Fan Palm.

LEAVES light green, their petioles stout and elongated.

Washingtonia filamentosa, O. Kuntze, *Rev. Gen. Pl.* ii. 737 (1891).

Brahea dulcis (?), Cooper, *Smithsonian Rep.* 1860, 342 (not Martius) (1861).

Pritchardia filamentosa, H. Wendland, *Bot. Zeit.* xxxiv. 807 (1876). — Fenzi, *Bull. Soc. Tosc. Ort.* i. 116, f.

Pritchardia filifera, Linden, *Ill. Hort.* xxiv. 32, 107 (1877).

Washingtonia filifera, H. Wendland, *Bot. Zeit.* xxxvii. 68 (1879). — Brewer & Watson, *Bot. Cal.* ii. 211, 485. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 217. — Sprenger, *Bull. Soc. Tosc. Ort.* xiv. 319, f. 37.

A tree, occasionally seventy-five feet in height, with a trunk sometimes fifty or sixty feet tall, from two to three feet in diameter, covered with a thick light red-brown slightly scaly rind, and clothed layer over layer with a thick thatch of dead pendent leaves descending in a regular cone from the living crown sometimes nearly to the ground.[1] The living leaves, which vary from forty to sixty in number, are light green, slightly tomentose on the folds, five or six feet in length and four or five feet in width, and are borne on petioles from four to six feet long, about two inches broad at the apex, where they widen slightly into the ligulas, which are about four inches in length and cut irregularly into long narrow lobes, about five inches wide at the base, where they dilate into the sheaths, which are sixteen or eighteen inches long and twelve or fourteen inches wide, and are armed with broad thin large and small straight or hooked spines. The flower-clusters are from ten to twelve feet in length, three or four being produced each year from the axils of upper leaves, the slightly fragrant flowers opening late in May or early in June; they are at first erect and spreading, becoming pendulous as the fruit matures, glabrous and light green; the stems and branches are compressed and slightly wing-margined toward the base, slender and terete above, and divided into three or four primary branches bearing elongated pendulous secondary branches furnished with numerous long densely flowered branchlets, the upper being simple and erect, and the lower spreading and paniculate; the outer spathe which incloses the panicle in the bud is narrow, elongated, and glabrous; and those of the secondary branches are coriaceous, yellow tinged with brown, laciniate at the apex, the upper being lorate and coated on the margins with loose pale caducous tomentum. The fruit, which is produced in great profusion, ripens in September, and is a third of an inch in length. The seed is a quarter of an inch long and an eighth of an inch thick.

Washingtonia filamentosa, which is the largest of the Palms of the United States, sometimes forms extensive open groves[2] or small isolated clumps, and grows in wet usually alkaline soil along the eastern borders of the depression in the Colorado Desert, which an inland sea once filled, following the line of connection between this depression and the Gulf of California into Lower California, and sometimes extending for several miles up the cañons of the San Bernardino and San Jacinto Mountains, a small grove in White Water Cañon on the eastern slope of the San Bernardino Mountains marking the western and northern limits of its range.[3]

[1] This thatch of dead leaves makes the best possible protection for the trunk from the burning heat and drying winds of the desert. Its inflammable material, however, is easily kindled by accidental fires, and is usually burned off by Indians in order to facilitate the ascent of the trunk to gather the fruit. The dead leaves have thus been burned from nearly all the trees in the desert, and the vitality of this Palm is shown by its ability to withstand the effects of such constant abuse, and the removal of its protective covering. (See S. B. Parish, *Garden and Forest*, iii. 51.)

[2] *Garden and Forest*, viii. 472, f. 65.

[3] S. B. Parish, *Zoë*, iv. 349.

The wood of *Washingtonia filamentosa* is light and soft, and contains numerous conspicuous dark orange-colored fibro-vascular bundles. The specific gravity of the absolutely dry wood is 0.5173, a cubic foot weighing 32.24 pounds. It contains a quantity of sugar; and the ashes, which amount to 11.86 per cent. of the dry wood, contain 25 per cent. of salt.[1]

The fruit is gathered and used as food by the Indians, who also grind the seeds into flour.[2]

First cultivated by the Jesuit priests in their mission gardens of southern California long before this region became a part of the United States,[3] *Washingtonia filamentosa* was noticed by the botanists connected with the commission intrusted with the establishment of the boundary between the United States and Mexico, but was not described until many years later. It has now become one of the commonest trees in the gardens and streets of the southwestern part of California, growing rapidly and vigorously there,[4] as it does in southern Europe, where, in a comparatively short time, it has attained a large size and produced flowers and fruit,[5] and also in Rio de Janeiro.[6]

[1] Trimble, *Garden and Forest*, ix. 133.

[2] Palmer, *Am. Nat.* xii. 598.

[3] Two specimens in San Pedro Street, Los Angeles, believed to have been planted by the Jesuit missionaries, with stems nearly nine feet through at the ground, are estimated to be one hundred feet high. (See Kinney, *Scientific American*, lx. 263, f.)

[4] *Garden and Forest*, vi. 535, f. 77.

[5] W. Watson, *Garden and Forest*, vii. 45. — André, *Rev. Hort.* 1895, 153, f. 40–42.

[6] Nicholson, *Garden and Forest*, ii. 578.

EXPLANATION OF THE PLATE.

Plate DIX. Washingtonia filamentosa.

1. A branch of a flowering spadix, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. Vertical section of a flower, enlarged.
5. A stamen, enlarged.
6. Portion of a corolla laid open, showing the glands at the base of the petals, enlarged.
7. Portion of a fruiting spadix, natural size.
8. A fruit divided transversely, enlarged.
9. Vertical section of a fruit, enlarged.
10. A seed, basal view, enlarged.
11. An embryo, much magnified.
12. A leaf, upper side, much reduced.
13. Portion of a leaf-stalk, somewhat reduced.

C.E.Faxon del. Rapine sc.

WASHINGTONIA FILAMENTOSA, O.K.

A. Riocreux direx.t Imp. J. Taneur, Paris.

THRINAX.

FLOWERS perfect; calyx and corolla confluent into a short cup, 6-toothed on the margin; stamens 6 to 12; ovary usually 1-celled; ovule basilar, erect. Fruit drupaceous; pericarp dry or fleshy. Spadix interfoliar, paniculate. Leaves orbicular, or truncate at the base, petiolate, the petioles unarmed.

Thrinax, Swartz, *Prodr.* 57 (1788). — Endlicher, *Gen.* 253. — Meisner, *Gen.* 357. — Bentham & Hooker, *Gen.* iii. 930. — Drude, *Engler & Prantl Pflanzenfam.* ii. pt. iii. 34. — Baillon, *Hist. Pl.* xiii. 317.

Hemithrinax, Hooker f. *Bentham & Hooker Gen.* iii. 930 (1883).

Small unarmed trees or shrubs, with simple or clustered endogenous stems marked below by the ring-like scars of fallen leaves, and clothed above with the long-persistent petiole-sheaths. Leaves terminal, induplicate in vernation, alternate, flabellate, orbicular, or truncate at the base, more or less deeply divided into narrow acute two-parted plicately folded lobes; rachises short or wanting; ligulas free, erect, concave, often apiculate; petioles compressed, slightly rounded and ridged on both sides, their margins thin and smooth, gradually enlarged below into elongated vaginas of coarse fibres often forming an open conspicuous network and generally clothed while young with thick felt-like hoary tomentum. Spadix interfoliar, paniculate, elongated, pedunculate, its primary branches alternate, furnished with numerous short slender graceful flower-bearing secondary branchlets produced in the axils of scarious acute bracts; spathes numerous, tubular, coriaceous or papyraceous, splitting at the apex, inserted on the rachis of the panicle, each primary branch with its spathe and the node of the rachis below it inclosed in a separate spathe, the whole surrounded by the larger spathe of the node next below. Flowers solitary or rarely in two or three-flowered clusters, minute, articulate on slender elongated or short broad pedicels in the axils of caducous bracts, usually bibracteolate, the bractlets minute and caducous. Sepals and petals confluent into a cup-shaped or ring-like perianth, truncate at the base, six-toothed on the margin. Stamens six, nine, or twelve, inserted on the base of the perianth; filaments subulate, filiform or triangular, slightly united at the base, exserted, or wanting; anthers oblong or linear-oblong, attached on the back, introrse or extrorse, two-celled, the cells free below, opening longitudinally. Ovary superior, ovoid, or globose, one or rarely two or three-celled, narrowed above into a slender columnar style crowned by a funnel-formed often oblique stigma; ovule solitary in each cell, basilar, erect, semianatropous, the micropyle inferior or sublateral. Fruit subglobose, black, or light orange-colored, crowned with the remnants of the style, raised on a thickened stalk, surrounded at the base by the persistent perianth of the flower; exocarp thick or thin, fleshy or crustaceous, closely investing the thin membranaceous endocarp. Seed free, globose or depressed-globose; testa thin, light tawny brown and vertically sulcate, or dark chestnut-brown and lustrous; albumen horny, ruminate, or uniform and deeply penetrated by a broad basal cavity; hilum minute, or oblong and conspicuous, basilar or subbasilar; raphe branched, inconspicuous.[1]

[1] By Drude (Engler & Prantl, *Pflanzenfam.* ii. pt. iii. 34) the following sections are proposed: —

EUTHRINAX. Flowers solitary, long-pedicellate; perianth lobes minute; filaments elongated; anthers introrse; pericarp thin and subsucculent, or thick and succulent; seed vertically sulcate by the infolding of the light tawny brown testa into the ruminate albumen.

HEMITHRINAX. Flowers solitary or rarely in 2 or 3-flowered clusters, sessile or short-pedicellate; perianth lobes setulose; anthers sessile, extrorse; pericarp crustaceous; seed depressed at the base, dark chestnut-brown and lustrous; albumen uniform, penetrated by a broad deep basal cavity.

POROTHRINAX. Flowers solitary, short-pedicellate; perianth lobes broadly ovate, acute; filaments triangular; anthers introrse, becoming reflexed and extrorse at maturity; pericarp crustaceous; seed depressed at the base, dark chestnut-brown and lustrous; albumen uniform, penetrated by a broad deep basal cavity.

Thrinax is confined to the New World, where it is distributed from the Bahama Islands and southern Florida through the West Indies to the Isthmus of Panama. Twelve species are described, although with regard to several of them little is yet known. Four and probably five species[1] inhabit southern Florida, one of them being a low shrub.[2]

The large coriaceous tough fan-shaped leaves of many of the species are used to thatch the roofs of buildings; and several of the species are cultivated as ornamental plants in the tropics and in the glass-houses of northern gardens.[3]

The generic name, from θρῖναξ, alludes to the form of the leaves.

[1] In addition to the species of Thrinax described in this volume, there is another arborescent Euthrinax on the Marquesas Keys and probably on some of the keys east of Key West. It is a low tree, with a thick trunk raised above the surface of the ground by a cluster of stout roots, large leaves, and fruit remarkable for the thickness of the fleshy pericarp.

Portions of a leaf and a few fruits of a Thrinax-like Palm collected by Dr. A. P. Garber at Cape Sabal in October, 1879, and preserved in the Gray Herbarium, indicate the presence of another Porothrinax in Florida.

[2] *Thrinax Garberi*, Chapman, *Bot. Gazette*, iii. 12 (1878); *Fl.* ed. 2, Suppl. 651.

[3] H. Wendland, *Index Palmarum*, 39.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

EUTHRINAX.

Pedicels stout, elongated; filaments filamentose; fruit dark brown, with thin dry flesh; seed light tawny brown, conspicuously sulcate; albumen ruminate . . . . . 1. T. PARVIFLORA.

POROTHRINAX.

Pedicels short, disk-like; filaments triangular; fruit orange-brown, the pericarp crustaceous; seed dark chestnut-brown and lustrous; albumen uniform . . . . . 2. T. MICROCARPA.

THRINAX PARVIFLORA.

Silk-Top Palmetto.

PEDICELS stout, elongated; filaments filamentose. Fruit dark brown, with thin dry flesh; seed light tawny brown, conspicuously sulcate.

Thrinax parviflora, Swartz, *Prodr.* 57 (1788); *Fl. Ind. Occ.* i. 614, t. 13. — Aiton, *Hort. Kew.* iii. 473. — Willdenow, *Spec.* ii. pt. i. 202. — Persoon, *Syn.* i. 383. — Lunan, *Hort. Jam.* ii. 28. — Poiret, *Lam. Dict.* vii. 635. — Titford, *Hort. Bot. Am.* 112. — Sprengel, *Syst.* ii. 20. — Roemer & Schultes, *Syst.* vii. pt. ii. 1300. — Martius, *Hist. Nat. Palm.* iii. 255, t. 103. — Kunth, *Enum.* iii. 253. — Dietrich, *Syn.* ii. 1091. — Walpers, *Ann.* v. 818. — Grisebach, *Fl. Brit. W. Ind.* 515. — Vasey, *Rep. U. S. Dept. Agric.* 1875, 186 (*Cat. Forest Trees U. S.*). — Chapman, *Bot. Gazette*, iii. 12; *Fl.* ed. 2, Suppl. 651. — Eggers, *Bull. U. S. Nat. Mus.* No. 13, 118 (*Fl. St. Croix and the Virgin Islands*). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 217.

A tree, in Florida from twenty to thirty feet in height, with a slender stem four or five inches in diameter, covered with thin smooth blue-gray rind. The leaves are orbicular, from three to four feet in diameter, thin, bright green on the upper surface, paler and coated while young on the lower surface with pale caducous tomentum, and, except at the base, where they are split nearly to the ligula, divided for about two thirds of their diameter into laciniate lobes, with stout yellow midribs prominent on the upper side, and with much thickened reflexed margins; the lobes near the middle of the leaf are from an inch to an inch and a quarter broad, diminishing in width toward the base of the leaf, where they are not more than a quarter of an inch wide; the rachis of the leaf is reduced to a thin truncate undulate border, and the ligula is crescent-shaped, about an eighth of an inch long, a quarter of an inch thick, and an inch wide, and is furnished near the middle with a flat nearly triangular point half an inch long; the petiole is thin and flexible, three quarters of an inch wide at the base of the blade, rounded and ridged on the upper and lower sides, about as long as the blade of the leaf, and enlarged below into the elongated sheath, which is coated while young with a thick felt-like hoary tomentum. Three or four panicles of flowers, from two to three feet in length, usually appear each year, the flowers opening in Florida in the autumn; their secondary branches are much flattened, recurved, and from four to six inches in length, the slender flower-bearing branchlets being from an inch and a half to five inches long, and in the axils of ovate acute scarious brownish bracts about three quarters of an inch long and an eighth of an inch wide; the spathes are coriaceous, pubescent above the middle, and often ciliate on the margins at the apex. The flowers, which are raised on rigid spreading pedicels an eighth of an inch in length, consist of a cup-like six-lobed perianth, six or nine stamens, with slender exserted filaments slightly united below and large oblong light yellow anthers, and a subglobose dark orange-colored ovary surmounted by an elongated style dilated into a broad oblique stigma. The fruit, which ripens in April, is dark chestnut-brown or nearly black, and rather less than a quarter of an inch in diameter, with a thin somewhat fleshy outer coat closely investing the rather thicker crustaceous light brown inner coat, and a deeply furrowed depressed-globose tawny brown seed an eighth of an inch in diameter, with ruminate albumen.

In Florida *Thrinax parviflora* has been found only on the southern keys from Bahia Honda to Long's Key, usually growing in low moist sandy soil or in sandy swamps. It also inhabits the Bahama Islands and many of the Antilles.

The wood of *Thrinax parviflora* is light, soft, and pale brown, with a hard outer rim about an eighth of an inch in thickness, and contains numerous hard inconspicuous fibro-vascular bundles. The specific gravity of the absolutely dry wood is 0.5991, a cubic foot weighing 37.34 pounds.

In Florida the trunks are sometimes used in making sponge and turtle-crawls.

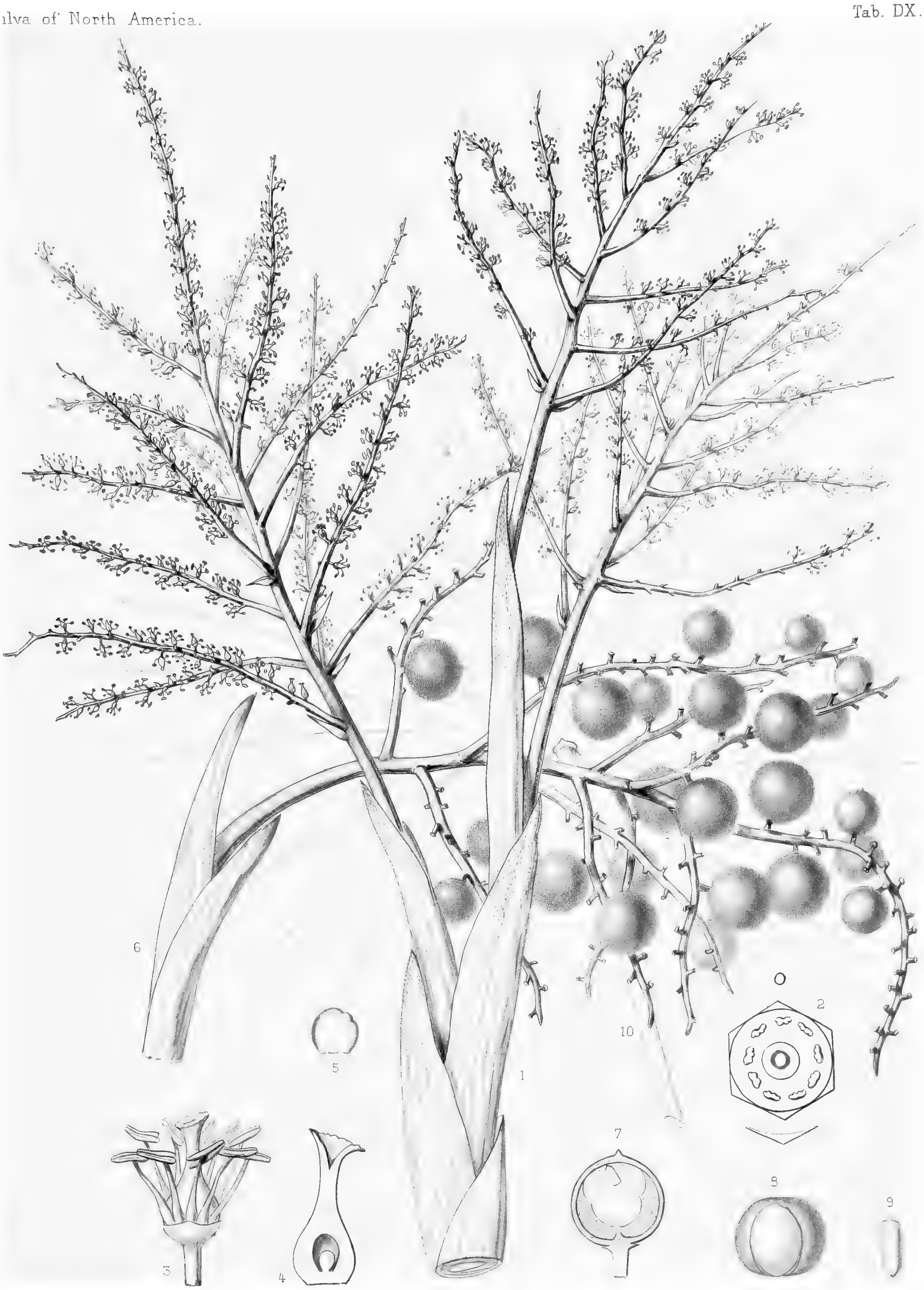
Thrinax parviflora appears to have been first noticed in Florida by Dr. A. W. Chapman[1] in 1875.

[1] See vii. 110.

EXPLANATION OF THE PLATE.

PLATE DX. THRINAX PARVIFLORA.

1. Portion of a flowering spadix, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. Vertical section of a pistil, enlarged.
5. An embryo, much magnified.
6. A branch of a fruiting spadix, natural size.
7. Vertical section of a fruit, enlarged.
8. A seed, enlarged.
9. An embryo, much magnified.
10. A leaf, upper surface, much reduced.



C. E. Faxon del.

Himely sc.

THRINAX PARVIFLORA, Sw.

A. Riocreux direx.t.

Imp. J. Taneur, Paris.

THRINAX MICROCARPA.

Silver-Top Palmetto. Brittle Thatch.

PEDICELS short, disk-like; filaments triangular. Fruit orange-brown, the pericarp crustaceous; seed dark chestnut-brown and lustrous.

Thrinax microcarpa, Sargent, *Garden and Forest*, ix. 162 (1896).

Thrinax argentea, Chapman, *Fl.* ed. 2, Suppl. 651 (not Roemer & Schultes) (1883). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 218.

A tree, in Florida rarely more than thirty feet in height, with a trunk eight or ten inches in diameter, covered with thin smooth pale blue-green rind. The leaves are orbicular, coriaceous, pale green above, silvery white below, more or less thickly coated while young with hoary tomentum at the base, especially on the lower surface, from two to three feet across, and split to below the middle or near the base of the leaf almost to the rachis into divisions which are an inch wide at the middle of the leaf, and rather less than a quarter of an inch wide at its base, and are thickened and revolute on the margins, with midribs thickened and prominent on the upper side and slender veins; the rachises are short, slightly convex, and gradually narrowed and rounded at the apex; the ligulas are orbicular, thick, concave, an inch wide, and lined with a thick coat of white tomentum; the petioles are thin and flexuose, an inch wide at the apex, and gradually widened below into elongated light brown sheaths of slender fibres. The flower-clusters, which appear in April, are elongated, with short compressed erect secondary branches, slightly spreading below, gracefully incurved above the middle, and furnished with numerous slender pendulous flower-bearing branchlets subtended by small lanceolate acute scarious bracts; the spathes are elongated, acute, deeply parted at the apex, coriaceous, and coated above the middle with thick hoary tomentum. The flowers are solitary, articulate on short thick disk-like pedicels, and about an eighth of an inch long; the cupular perianth is truncate at the base and six-lobed, with broadly ovate acute lobes half as long as the ovary. The stamens are six in number, with thin nearly triangular exserted filaments slightly united at the base and slender at the apex, and oblong anthers, which are attached on the back near the bottom and versatile, becoming reversed and extrorse at maturity. The ovary is ovoid, deep orange-colored, one-celled, and narrowed above into a short thick style dilated into a large funnel-formed stigma. The fruit, which ripens late in the autumn or during the winter, is globose, an eighth of an inch in diameter, dull yellow-brown, surmounted by the remnants of the style, surrounded at the base by the slightly enlarged obscurely six-lobed thickened perianth of the flower, and raised on a short thick stalk; the outer coat is thin, brittle, and closely invests the much thinner membranaceous inner coat, which is light brown and lustrous on the inner surface. The seed is subglobose, with uniform albumen, bright dark chestnut-brown, and depressed and marked at the base by the conspicuous oblong pale hilum.

The wood of *Thrinax microcarpa* is light and soft, and contains numerous small fibro-vascular bundles, the interior of the trunk being spongy and much lighter than the hard exterior rim, which is from half an inch to an inch in thickness, and, when absolutely dry, has a specific gravity of 0.7172, a cubic foot weighing 44.70 pounds. The stems are used for wharf-piles, and the thick coriaceous brittle leaves are employed as thatch, and manufactured into coarse ropes.

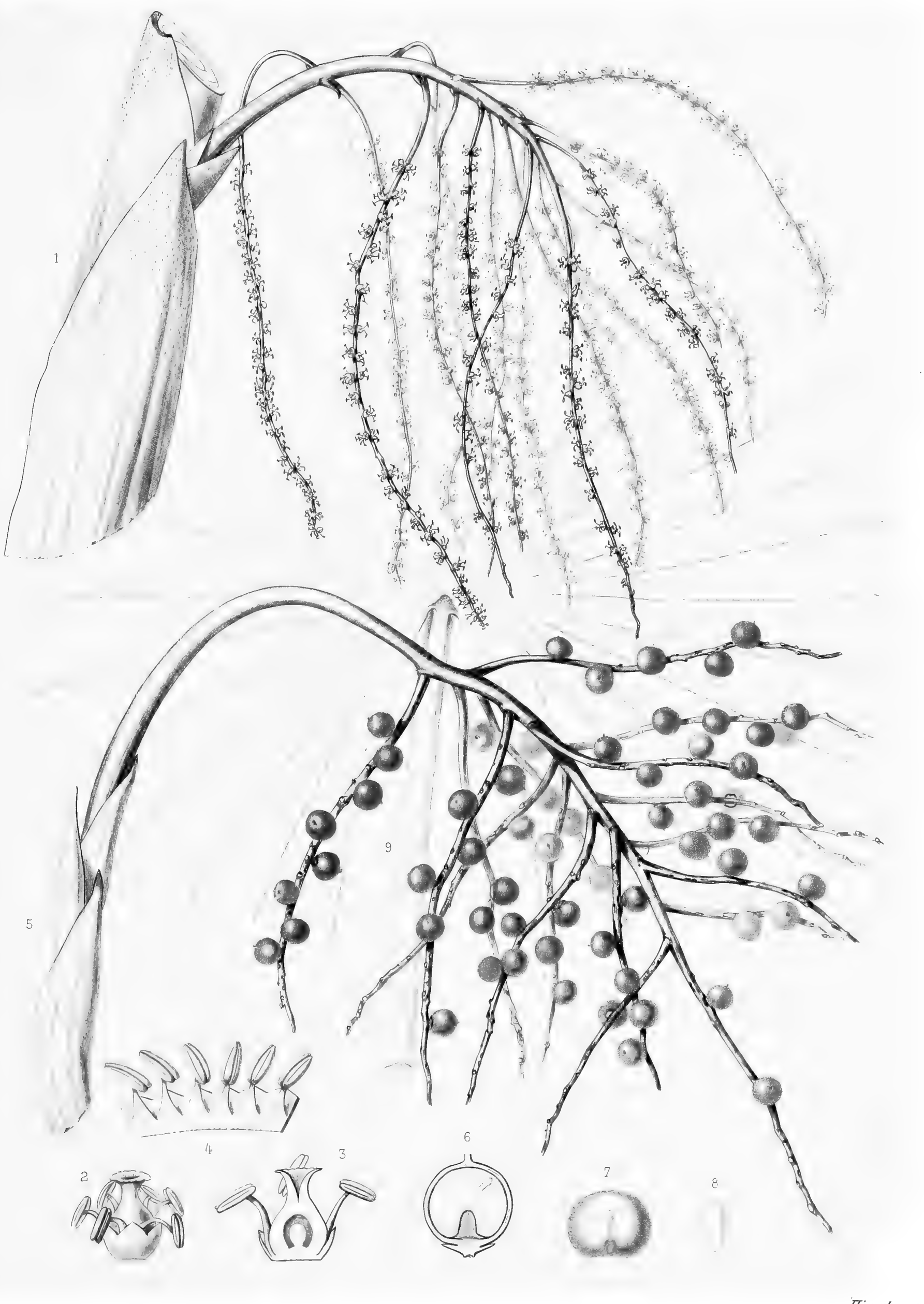
Thrinax microcarpa grows in dry coral soil, and inhabits No-name Key, Bahia Honda Key, and the shores of Sugar Loaf Sound in southern Florida. It was discovered by Mr. A. H. Curtiss[1] in 1879.

[1] See ii. 50.

EXPLANATION OF THE PLATE.

Plate DXI. Thrinax microcarpa.

1. A branch of a flowering spadix, natural size.
2. A flower, enlarged.
3. Vertical section of a flower, enlarged.
4. A perianth with stamens, displayed, enlarged.
5. A branch of a fruiting spadix, natural size.
6. Vertical section of a fruit, enlarged.
7. A seed, basal view, enlarged.
8. An embryo, much magnified.
9. A leaf, upper surface, much reduced.



C E. Faxon del.

Himely sc

THRINAX MICROCARPA, Sarg.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

TUMION.

FLOWERS naked, diœcious, solitary, axillary; stamens numerous; filaments dilated above into 4 anthers connate into a half ring; ovule solitary, erect, surrounded by a fleshy aril becoming confluent with the woody testa of the seed. Leaves lanceolate, alternate, spreading in two ranks, persistent.

Tumion, Rafinesque, *Amen. Nat.* 63 (1840). — Greene, *Pittonia*, ii. 193.

Torreya, Arnott, *Ann. Nat. Hist.* i. 130 (not Rafinesque, Sprengel, nor Eaton) (1838). — Endlicher, *Gen.* Suppl. i. 1373. — Meisner, *Gen.* 353. — Bentham & Hooker, *Gen.* iii. 431. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 111. — Baillon, *Hist. Pl.* xii. 31. — Masters, *Jour. Linn. Soc.* xxx. 5.

Caryotaxus, Henkel & Hochstetter, *Syn. Nadelh.* 365 (1865).

Fœtataxus (Nelson) Senilis, *Pinaceæ*, 167 (1866).

Glabrous fœtid or pungent-aromatic trees, with fissured bark, close-grained light-colored wood, ovate acute ternate buds in the axils of the upper leaves, the lateral rather smaller than the central, covered with numerous imbricated scales, increasing in size from below upward, the outer long-persistent on the base of the branchlet, those of the inner ranks scarious, accrescent, often erose on the margins, verticillate or opposite, spreading or drooping branches, slender terete branchlets marked in their fifth or sixth year with small slightly elevated oval transverse scars of fallen leaves, and fibrous roots. Leaves disposed in a subspiral, distichously spreading and suberect by the twisting of the short compressed petioles, linear-lanceolate, thin, gradually narrowed at the apex into long sharp rigid callous points, and abruptly contracted at the base, slightly rounded on the back, ecarinate, bisulcate below with a broad or narrow stomatiferous groove on each side of the midvein, revolute and slightly thickened on the entire margins, covered with a thick epidermis, dark green and lustrous on the upper surface, often rather paler on the lower; resin-canal solitary, central; fibro-vascular bundle semilunar, surrounded by an epiderm with thick-walled cells. Flowers appearing in very early spring, the staminate crowded in adjacent axils from globose buds formed in the autumn on branchlets of the year, and covered with numerous closely imbricated decussate ovate acute thick scales yellow tinged with red below, increasing in size from below upward, persistent, the inner accrescent, thin, erose on the margins; the pistillate scattered, and less numerous in the axils of leaves of the year or of the previous year, covered with broadly ovate rounded or apiculate thinner scales persistent under the fruit. Staminate flower ovoid or oblong, composed of six or eight close whorls, each of four divaricate stamens, subverticillately arranged on a slender subsessile axis, surrounded at the base by the persistent bud-scales; filaments short, flattened and expanded above into four globose pendulous anthers connate into a half ring, two-valved, introrse, their connective produced above the cells, slightly dilated, often denticulate on the upper margin; pollen-grains globose. Pistillate flower sessile, surrounded by the bud-scales, composed of a single orthotropous ovule, surrounded by and finally inclosed in an ovate fleshy urceolate sack, becoming at maturity an ovoid or obovate drupe-like purple or green fruit short-pointed at the apex, and separating when ripe from the basal scales persistent on a short stout peduncle, with a thin resinous leathery purple or green outer coat, developed from the aril-like covering of the ovule, closely investing the seed. Seed ovoid, acute at both ends, apiculate at the apex, marked at the base by the large conspicuous dark hilum; testa thick and woody; tegmen membranaceous or laminate, its

folds penetrating the fleshy more or less deeply ruminate white albumen. Embryo axile; cotyledons two, semiterete, shorter than the superior radicle.

Four species of Tumion have survived from the tertiary period, when the genus inhabited the Arctic Circle, and then, spreading southward, existed for a long time in Europe, whence it has now disappeared.[1] Of existing species, one, the type of the genus, inhabits Florida, a second is widely scattered through the forests of western California, one occurs on the mountains of central and southern Japan,[2] and another in northern China.[3]

Tumion produces handsome light-colored wood, occasionally used in cabinet-making, and sweet edible oily seeds.

In North America Tumion is not injured by insects or affected by fungal diseases.

The species can be easily raised from seeds, which, however, soon lose their vitality if allowed to become dry. They are occasionally cultivated, but as ornamental plants give little promise of attaining the size and beauty which they display in their native forests.

The generic name, from *θύμιον*, is said to have been given by Dioscorides to a species of Yew-tree.

[1] Saporta, *Origine Paléontologique des Arbres*, 59.

[2] *Tumion nuciferum*, Greene, *Pittonia*, ii. 194 (1891).

Torreya nucifera, Siebold & Zuccarini, *Abhand. Akad. Münch.* iv. pt. iii. 232 (1846); *Fl. Jap.* ii. 64, t. 129. — Endlicher, *Syn. Conif.* 240. — Miquel, *Ann. Mus. Lugd. Bat.* iii. 169 (*Prol. Fl. Jap.*). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 505. — Franchet & Savatier, *Enum. Pl. Jap.* i. 473. — Masters, *Jour. Linn. Soc.* xviii. 500 (*Conifers of Japan*). — Beissner, *Handb. Nadelh.* 186.

Taxus nucifera, Linnæus, *Spec.* 1040 (1753). — Thunberg, *Fl. Jap.* 275. — Gærtner, *Fruct.* ii. 66, t. 91. — A. Richard, *Comm. Bot. Conif.* ii. t. 2, f. 3.

Podocarpus (?) *nucifera*, Persoon, *Syn.* ii. 633 (1807).

Caryotaxus nucifera, Henkel & Hochstetter, *Syn. Nadelh.* 366 (1865).

Fœtataxus nucifera (Nelson) Senilis, *Pinaceæ*, 168 (1866).

The Kaya, as *Tumion nuciferum* is called in Japan, is common in the forests of central and southern Hondo and in those of the southern islands, growing often as an undershrub or as a small tree from twenty to thirty feet high, but occasionally, especially on the banks of the Kisagawa in central Hondo, rising to the height of eighty feet, with a trunk four or five feet in diameter, and forming a tree unequaled in the massiveness of its appearance and in the beauty of its bright red bark and lustrous dark green, almost black foliage.

The kernels of the seeds, which possess a slightly resinous pleasant flavor, are an important article of food in Japan, and by pressure yield an oil, Kaya-no-abura, which is used in cooking, and is of considerable commercial importance. The light yellow wood is straight-grained, and is employed in building and cabinet-making (Rein, *Industries of Japan*, 94, 157, 231. — Sargent, *Forest Fl. Jap.* 76).

[3] *Tumion grande*, Greene, *l. c.* (1891).

Torreya (?) *grandis*, Gordon, *Pinetum*, 326 (1858). — Parlatore, *l. c.* — Franchet, *Nouv. Arch. Mus.* sér. 2, v. 292 (*Pl. David.* i.). — Masters, *l. c.* — Beissner, *l. c.* 185.

Caryotaxus grandis, Henkel & Hochstetter, *l. c.* 367 (1865).

Little is known in regard to the distribution and uses of this inhabitant of the mountain forests of northern China, which was introduced into English gardens by Fortune in 1847, and it is not improbable that it may prove to be specifically identical with the Japanese species.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves slightly rounded on the back, pale on the lower surface. Fruit purple. Leaves, branches, and wood fœtid . . . . . 1. T. TAXIFOLIUM.

Leaves nearly flat, green below, elongated. Fruit green, slightly tinged with purple. Leaves and branches pungent-aromatic . . . . . 2. T. CALIFORNICUM.

TUMION TAXIFOLIUM.

Stinking Cedar. Torreya.

LEAVES slightly rounded on the back, pale on the lower surface. Fruit purple. Leaves and branches fœtid.

Tumion taxifolium, Greene, *Pittonia*, ii. 194 (1891).

Torreya taxifolia, Arnott, *Ann. Nat. Hist.* i. 130, t. (1838). — Hooker, *Icon.* iii. t. 232, 233. — Nuttall, *Sylva*, iii. 91, t. 109. — Spach, *Hist. Vég.* xi. 298. — Endlicher, *Syn. Conif.* 241. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 226. — Carrière, *Traité Conif.* 514. — Gordon, *Pinetum*, 329. — Chapman, *Fl.* 436. — Hoopes, *Evergreens*, 387, f. 62. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 505. — K. Koch, *Dendr.* ii. pt. ii. 100. — Veitch, *Man. Conif.* 311. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 186. — Lauche, *Deutsche Dendr.* ed. 2, 49, f. 2. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 111, f. 70, a, b. — Beissner, *Handb. Nadelh.* 186, f. 46. — Masters, *Jour. R. Hort. Soc.* xiv. 254. — Koehne, *Deutsche Dendr.* 6.

Caryotaxus taxifolia, Henkel & Hochstetter, *Syn. Nadelh.* 367 (1865).

Fœtataxus montana (Nelson) Senilis, *Pinaceæ*, 167 (1866).

A fœtid tree, occasionally forty feet in height, with a short trunk from one to two feet in diameter, or usually much smaller, producing when cut many vigorous shoots from the stump and roots, and whorls of spreading slightly pendulous branches, which form a rather open pyramidal head tapering from a broad base. The bark of the trunk is about half an inch in thickness, brown, faintly tinged with orange-color, and irregularly divided by broad shallow fissures into wide low ridges slightly rounded on the back, and covered with thin closely appressed scales, which, in falling, disclose the yellow inner bark. The branchlets are slender, and are bright green for two or three years, and then gradually turn to a dark orange-red color. The winter-buds are covered with loosely imbricated scales; those of the outer ranks are keeled and thickened on the back, narrowed at the apex into short callous tips, and light green, lustrous and more or less tinged with purple on the outer surface, those of the inner ranks being thin and scarious, erose on the margins, and from one half to three quarters of an inch long when fully grown. The leaves are slightly falcate, an inch and a half long, about an eighth of an inch wide, tipped with elongate slender rigid callous points, somewhat rounded, dark green and lustrous above, rather paler and marked below with broad shallow grooves. The flowers appear during March and April, the staminate being a quarter of an inch in length, with pale yellow anthers and thick rigid ovate acute scales rounded on the back, while the broadly ovate female flower, which is abruptly narrowed and short-pointed at the apex, with a dark purple fleshy covering to the ovule, is an eighth of an inch long, and inclosed at the base by broad thin rounded scales. The fruit, which is produced rather sparingly, attains its full size at midsummer, but does not fall from the branches until late in the autumn; it is slightly obovate, dark purple, from an inch to an inch and a quarter long, and three quarters of an inch broad, with a thin leathery covering, a light red-brown seed furnished on the inner surface of the brittle woody testa with two opposite longitudinal thin ridges extending from the base toward the apex,[1] and conspicuously ruminate albumen penetrated by the red-brown inner seed-coat.

Tumion taxifolium is distributed for a distance of forty miles on the eastern bank of the Appalachicola River, Florida, from River Junction[2] to the neighborhood of Bristol, Gadsden County,

[1] The projecting summits of these ridges on the inner surface of the testa of *Tumion taxifolium* were found by Torrey, who first noticed them (*Ann. Nat. Hist.* i. 129), to be perforated and to communicate "obliquely downwards with a foramen on the external surface of the nut." I have not seen them on the other species which I have examined.

[2] River Junction, which was formerly called Chattahoochee, is at the junction of the Chattahoochee and Flint Rivers, where their united streams form the Appalachicola.

growing in calcareous soil on the bluffs of the river and for a few miles along its tributaries, on the slopes of ravines, which open to the river through the bluffs, and on the borders of its swamps.[1]

The wood of *Tumion taxifolium* is hard and strong, although light and rather brittle, and is close-grained, with a satiny surface, susceptible of receiving a beautiful polish; it contains thin inconspicuous bands of small summer-cells and numerous obscure medullary rays. It is clear bright yellow, with thin lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.5145, a cubic foot weighing 32.06 pounds.[2] Exceedingly durable in contact with the soil, it has been largely used locally for fence-posts, with the result that most of the large specimens have been destroyed.

Tumion taxifolium was found in 1833[3] by Mr. H. B. Croom[4] on the bluffs of the Appalachicola, opposite the town of Aspalaga. Introduced by its discoverer into northern gardens, it has proved hardy as far north as eastern Massachusetts, although a mild climate is necessary to develop all its beauty, and in western Europe.

[1] Gray, *Scientific Papers*, ii. 187 (*A Pilgrimage to Torreya*). — Chapman, *Bot. Gazette*, x. 251, with a map of the country occupied by this tree.

[2] *Tumion taxifolium* appears to grow comparatively slowly. The specimen in the Jesup Collection of North American Woods in the American Museum of Natural History in New York is fourteen inches in diameter inside the bark, and displays ninety-nine layers of annual growth. This tree, however, was probably shaded during the first fifty years of its life, as it grew less rapidly then than in its second half century.

[3] The first notice of Tumion was published in 1834 by Nuttall (*Jour. Phil. Acad.* vii. 96), who suggested that it might be the Mexican *Taxus montana*.

[4] Hardy B. Croom (1799–1836) was born of wealthy parents in Lenoir County, North Carolina, and was graduated with honor from the State University. He studied law in New Berne, and was admitted to the bar, but never practiced. Having married in New Berne, he devoted himself to the care of large cotton plantations, and became interested in planting in western Florida, which he visited annually for several years, traveling from North Carolina in his private carriage, attended by outriders, and accompanied by a supply-wagon containing a tent and camping outfit. On one of these journeys he discovered Tumion on the bluffs of the Appalachicola opposite Aspalaga, where one of his plantations was situated. Mr. Croom with his wife and three children passed the summer of 1836 in New York, and, embarking for Charleston on the steamship Hope in September, the whole family was lost at sea by the foundering of the vessel.

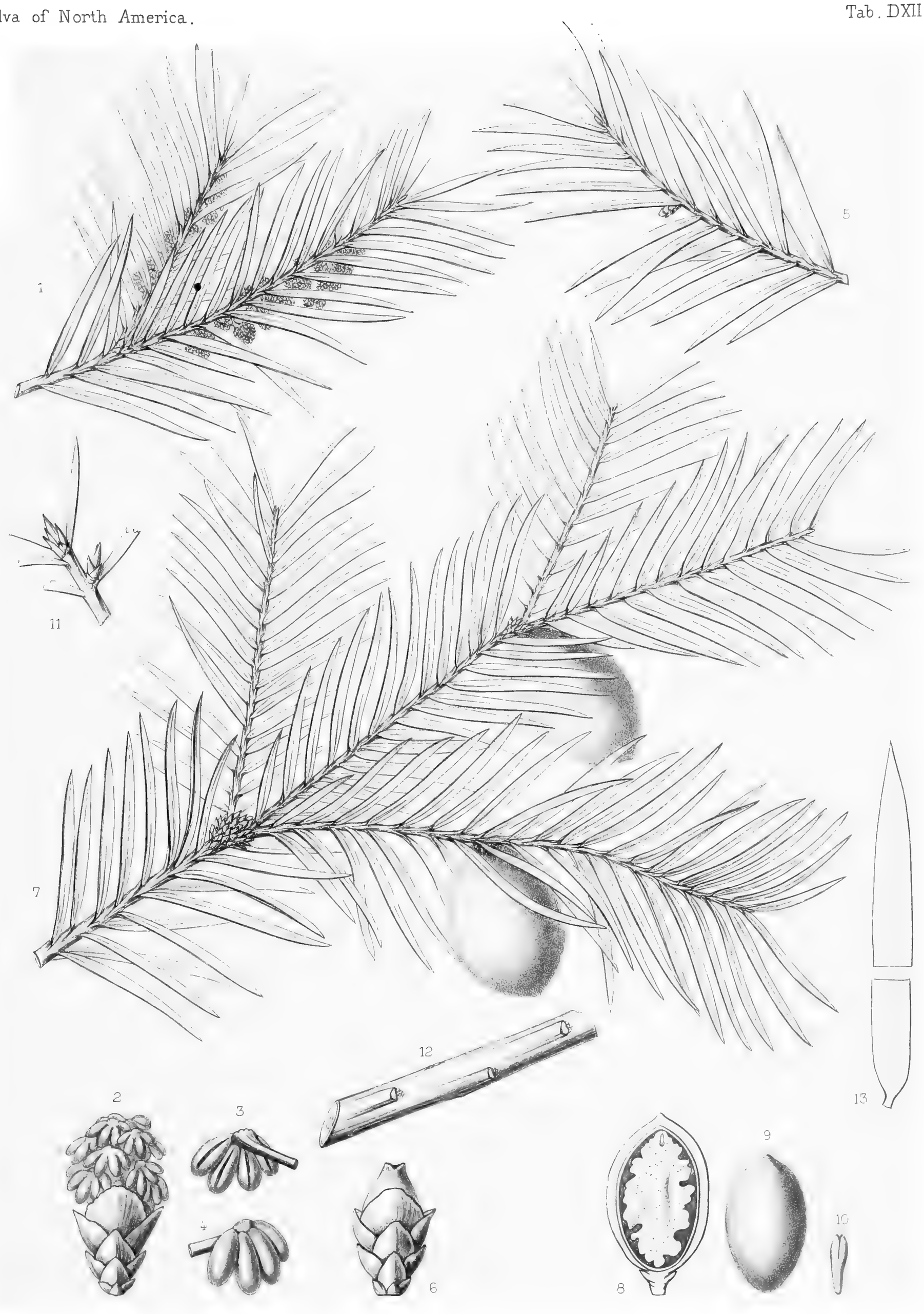
Mr. Croom published in *The American Journal of Science* in 1834 and 1835 three papers on the botany of the southern states, in which several new species were proposed, and much information upon the distribution of others was first printed. A paper by him on the genus Sarracenia, in which he first described *Sarracenia Drummondii*, appeared in the fourth volume of the *Annals of the Lyceum of Natural History* of New York. In 1837, after his death, his *Catalogue of Plants, native or naturalized in the vicinity of New Bern*, North Carolina, appeared with a preface by Dr. Torrey, a previous edition prepared in connection with Dr. H. Loomis having been issued in 1833. Intending to devote himself to the study of botany and the exploration of Florida, Mr. Croom had begun arrangements for the publication of that sequel to Michaux's *Sylva of North America* which was afterwards executed by Nuttall.

Croomia, an humble herb found by him growing under the shade of Tumion on the banks of the Appalachicola, with one species confined to the southeastern United States and another to Japan, recalls the name of a modest, amiable, and scholarly man. (See preface to *Catalogue of Plants of New Bern*, ed. 2.)

EXPLANATION OF THE PLATE.

PLATE DXII. TUMION TAXIFOLIUM.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, rear view, enlarged.
4. A stamen, front view, enlarged.
5. A flowering branch of the pistillate tree, natural size.
6. A pistillate flower, enlarged.
7. A fruiting branch, natural size.
8. Vertical section of a fruit, natural size.
9. A seed, natural size.
10. An embryo, enlarged.
11. End of a branch with winter-buds, natural size.
12. Portion of a branchlet with leaf-scars, natural size.
13. A leaf divided transversely, enlarged.



C.E.Faxon del. *Rapine sc.*

TUMION TAXIFOLIUM, Greene.

A.Riocreux direx. *Imp. J.Taneur, Paris.*

TUMION CALIFORNICUM.

California Nutmeg.

LEAVES nearly flat, green below, elongated. Fruit green, slightly tinged with purple. Leaves and branches pungent-aromatic.

Tumion Californicum, Greene, *Pittonia*, ii. 195 (1891). — Merriam, *North American Fauna*, No. 7, 343 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 225 (*Bot. Death Valley Exped.*). — Lemmon, *West-American Cone-Bearers*, 83.

Torreya Californica, Torrey, *N. Y. Jour. Pharm.* iii. 49 (1854); *Pacific R. R. Rep.* iv. pt. v. 140. — J. M. Bigelow, *Pacific R. R. Rep.* iv. pt. v. 24. — Kellogg, *Proc. Cal. Acad.* i. 35. — Newberry, *Pacific R. R. Rep.* vi. 61, 90, f. 27. — Hoopes, *Evergreens*, 385. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 506. — K. Koch, *Dendr.* ii. pt. ii. 101. — Gordon, *Pinetum*, ed. 2, 410. — Brewer & Watson, *Bot. Cal.* ii. 110. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 186. — Lauche, *Deutsche Dendr.* ed. 2, 50. — Hooker f. *Gard. Chron.* n. ser. xxiv. 553, f. 125. — Lemmon, *Rep. California State Board Forestry*, iii. 186, t. 29 (*Cone-Bearers of California*). — Beissner, *Handb. Nadelh.* 188. — Masters, *Jour. R. Hort. Soc.* xiv. 254. — Hansen, *Jour. R. Hort. Soc.* xiv. 318 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 6.

Torreya Myristica, Hooker f. *Bot. Mag.* lxxx. t. 4780 (1854). — Van Houtte, *Fl. des Serres*, ix. 175, t. — Carrière, *Traité Conif.* 515. — Gordon, *Pinetum*, 327. — A. Murray, *Edinburgh New Phil. Jour.* n. ser. x. 7, t. 3. — Veitch, *Man. Conif.* 311.

Caryotaxus Myristica, Henkel & Hochstetter, *Syn. Nadelh.* 368 (1865).

Fœtataxus Myristica (Nelson) Senilis, *Pinaceæ*, 168 (1866).

Tumion Californicum, var. **littorale**, Lemmon, *West-American Cone-Bearers*, 84 (1895).

A tree, from fifty to seventy or, occasionally, one hundred feet in height,[1] with a trunk one or two or rarely four feet in diameter, sending up from the stem when cut numerous vigorous stems, and whorls of spreading slender slightly pendulous branches, which form a handsome pyramidal or, in old age, a round-topped head. The bark of the trunk is from one third to one half of an inch in thickness, gray-brown tinged with orange-color, and deeply and irregularly divided by broad fissures into narrow ridges covered with elongated loosely appressed plate-like scales. The slender branchlets are light green when they first appear, and become more or less tinged with olive-color during their first winter, and bright red-brown during their second season. The buds are ovate, acute, and a quarter of an inch long, and are covered by thick acute apiculate lustrous light red-brown scales. The leaves are slightly falcate, nearly flat, dark green and lustrous on the upper and somewhat lighter and marked with deep narrow grooves on the lower surface, tipped with slender callous points, from one inch to three inches and a half long, and from one sixteenth to nearly one eighth of an inch wide. The flowers appear in March and April; the staminate are about a third of an inch in length, with thin broadly ovate acute scales, the inner being scarious and erose on the margins; the pistillate are nearly a quarter of an inch long, with oblong-ovate rounded scales. The fruit is ovate or oblong-ovate, from an inch to an inch and a half in length, and light green more or less streaked with purple; the testa is thin and brittle, with a pale laminate inner seed-coat, deeply infolded into the ruminate albumen, which, resembling in structure that of the Nutmeg, has given to this tree its common name.

An inhabitant of the borders of mountain streams, and nowhere common, the California Nutmeg is widely distributed in California from Mendocino County to the Santa Cruz Mountains in Santa Clara County in the coast region, where, especially at the north, it grows to its largest size and is most abundant, and along the western slopes of the Sierra Nevada from Eldorado to Tulare County at elevations of from three to five thousand feet above the level of the sea.

[1] Kellogg, *Forest Trees of California*, 3.

The wood of *Tumion Californicum* is light, soft, close-grained, and not strong. It is a clear light yellow, with thin nearly white sapwood, and contains numerous obscure medullary rays and broad although not conspicuous bands of small summer cells. It is very durable in contact with the soil, and has a fine satiny surface susceptible of receiving a handsome polish. The specific gravity of the absolutely dry wood is 0.4760, a cubic foot weighing 29.66 pounds. It is occasionally used for fence-posts.[1]

It is not known who discovered *Tumion Californicum*.[2] It was introduced into English gardens in 1851 by William Lobb,[3] and is occasionally cultivated in European collections, where, although it has produced its flowers,[4] it does not grow with much vigor or promise to acquire the beauty which distinguishes this noble tree in the forests of northern California.

[1] The log specimen of *Tumion Californicum* in the Jesup Collection of North American Woods in the American Museum of Natural History in New York is fourteen and one quarter inches in diameter inside the bark, and is two hundred and seven years old, the layers of annual growth having steadily diminished in thickness after the first forty years.

[2] In 1853 Dr. Torrey received from a Mr. Sheldon specimens of *Tumion Californicum* which had been collected on the headwaters of the Feather and Yuba Rivers on the Sierra Nevada, with the information that the tree had been discovered two or three years previously, and had attracted considerable attention owing to the resemblance of its seeds to those of the Nutmeg. At about the same time seedling plants raised in the Parsons' Nursery in Flushing, New York, were seen by Dr. Torrey. (See *N. Y. Jour. Pharm.* iii. 49.)

[3] William Lobb (1809–1863), a native of Cornwall, applied himself to gardening as a young man, and entered the Veitchs' nursery at Exeter, where he devoted his leisure time to the study of botany. In 1840 he was sent by Mr. Veitch to South America for the purpose of collecting plants. Arriving in Rio de Janeiro, he explored the Orgãos Mountains, where he discovered a number of orchids and the beautiful *Pleroma elegans*. From Brazil he went to Buenos Ayres, crossed by the pampas and the Chilian Andes to Valparaiso, and then visited the forests of *Araucaria imbricata* to gather seeds of that conifer, which had previously been extremely rare in European plantations. He afterwards proceeded to Peru and Ecuador, and for two years collected plants on the Pacific coast. Returning to England in 1844, he sailed again for Brazil in April of the following year, and then went to Valparaiso for the purpose of exploring southern Chili, a region at that time little known to botanists. From Chili he introduced into cultivation at this time *Lapageria rosea*, *Escallonia macrantha*, *Philesia buxifolia*, *Embothrium coccineum*, *Desfontainea spinosa*, and several other plants, which have retained popular favor for garden decoration. He continued his explorations in Valdivia, Chiloe, and northern Patagonia, whence he introduced *Libocedrus cupressoides*, *Fitzroya Patagonica*, *Saxegothea conspicua*, *Podocarpus nubigena*, and the beautiful *Berberis Darwinii*.

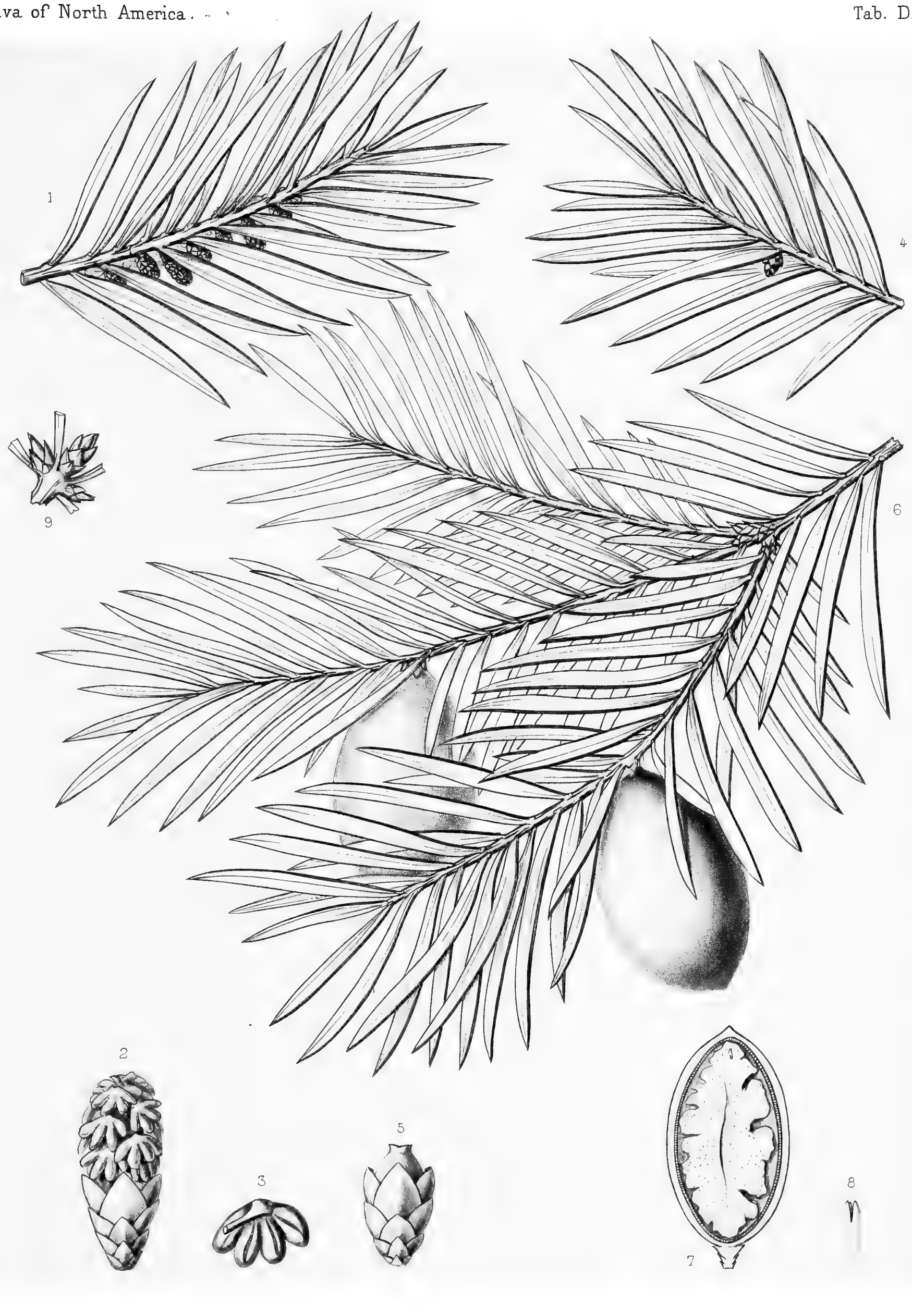
In 1848 Lobb returned to England, and was sent by Mr. Veitch to California to collect seeds of the then rare conifers known to science, and, if possible, to discover others. He landed in San Francisco in the autumn of 1849, and remained in California and Oregon for the remainder of his life, introducing into English gardens *Abies venusta*, *Abies magnifica*, *Abies concolor*, and *Sequoia Wellingtonia*. Of this last-named tree, he first sent cones and seeds to England, and when he returned home for a short visit in 1854, carried with him two living plants. In 1857 his connection with the Veitchs terminated; but he remained in California, and died of paralysis in San Francisco. William Lobb was one of the most successful of the botanists and explorers who helped to make known the trees of western North America, and in this connection his name will always be gratefully remembered with those of Douglas and Jeffrey.

[4] *Gard. Chron.* ser. 3, v. 800, f. 126, 127.

EXPLANATION OF THE PLATE.

Plate DXIII. Tumion Californicum.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, enlarged.
4. A flowering branch of the pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. A fruiting branch, natural size.
7. Vertical section of a fruit, natural size.
8. An embryo, much magnified.
9. Winter-buds, natural size.



C.E. Faxon del

Em. Himely sc.

TUMION CALIFORNICUM, Greene.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

TAXUS.

FLOWERS naked, diœcious or monœcious, solitary, axillary; the staminate stipitate; stamens 4 to 12; the pistillate sessile; ovule erect on a ring-like accrescent disk becoming a fleshy aril nearly inclosing the ripe seed. Leaves alternate, linear, persistent.

Taxus, Linnæus, *Gen.* 312 (1753). — Adanson, *Fam. Pl.* ii. 481. — A. L. de Jussieu, *Gen.* 412. — Endlicher, *Gen.* 216. — Meisner, *Gen.* 353. — Bentham & Hooker, *Gen.* iii. 431. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 112. — Baillon, *Hist. Pl.* xii. 31. — Masters, *Jour. Linn. Soc.* xxx. 7.

Verataxus (Nelson) Senilis, *Pinaceæ*, 168 (1866).

Long-lived slow-growing glabrous trees or shrubs, producing, when cut, numerous vigorous shoots from the stumps, with brown or dark purple bark, hard close-grained slightly resinous durable wood, slender terete green branchlets, small ovate acute buds in the axils of the two or three upper leaves, covered with numerous loosely imbricated acute light yellow-green scales increasing in size from below upward, the outer thick and firm, persistent on the base of the branchlet, the inner membranaceous and accrescent, and long fibrous roots. Leaves subspirally disposed, spreading, appearing distichous on lateral branchlets by the twisting of the short compressed petioles,[1] linear, often falcate, flat, acute and mucronate at the apex with slender ridged acute callous tips, gradually narrowed at the base, dark green, smooth and carinate on the upper surface, paler, papillate and stomatiferous on the lower, their margins slightly thickened and reflexed, vascular bundle single, ellipsoidal in section, without resin-canals, persistent for many years. Flowers opening in very early spring from globose buds covered with many thin ovate acute loosely imbricated light yellow-green scales often slightly tinged with red, decussate, appearing in autumn on branches of the year, the staminate numerous in adjacent axils, the pistillate scattered and less abundant. Staminate flower a quarter of an inch long, composed of a slender stipe surrounded at the base by the persistent bud-scales increasing in size from below upward, bearing at the apex a globose turbinate head of from four to eight pale yellow stamens; anthers subglobose before opening, depressed above, four to six-angled, light yellow, composed of from four to six conical pendent cells peltately connate from the apex of a short cylindrical filament, opening below introrsely, spreading and umbraculiform after the discharge of the globose pollen-grains, their connectives scarcely mucronulate. Pistillate flower sessile in the axil of the upper scale-like bract of a short axillary simple or rarely two-forked branch, and close to its minute tip,[2] subtended by five broadly ovate rounded thin decussate scales, more or less connate into a cup persistent under the fruit; ovule erect, orthotropous, sessile on an annular accrescent disk. Seed ripening and falling in the autumn, ovate-oblong, often obscurely three-angled, gradually narrowed and short-pointed at the apex, marked at the base by the large depressed triangular or oval hilum showing the ends of three fibro-vascular bundles, about a third of an inch long, entirely or nearly surrounded by, but free from, the now thickened succulent translucent sweet scarlet aril-like disk of the flower, truncate and open at the apex, separating in falling from the scales at its base and the short peduncle; seed-coat thick, of two layers, the outer thin and membranaceous or fleshy, the inner much thicker, subligneous. Embryo axile in copious fleshy uniform albumen; cotyledons two, shorter than the superior radicle.

Taxus, which is confined to the northern hemisphere, is homomorphous, the six species which are

[1] On the leading shoots and on the fastigiate branches of some of the forms of *Taxus baccata* the petioles are not twisted, and the spiral arrangement of the leaves is apparent. (See Masters, *Jour. Linn. Soc.* xxx. 7.)

[2] Eichler, *Blüthendiagramme*, pt. i. 64.

now recognized being only distinguishable by trivial leaf-characters and by habit. Four species are found in North America; one,[1] the type of the genus, is widely distributed through Europe, northern Africa, and Asia, and another[2] is confined to western continental Asia and Japan. In North America

[1] *Taxus baccata*, Linnæus, *Spec.* 1040 (1753). — De Candolle, *Lamarck Fl. Franç.* ed. 3, iii. 280. — Spach, *Hist. Vég.* xi. 292, t. 132. — Ledebour, *Fl. Ross.* iii. 666. — Reichenbach, *Icon. Fl. German.* xi. 7, t. 538. — Hartig, *Forst. Culturpfl. Deutschl.* 92, t. 9. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 23. — Parlatore, *Fl. Ital.* iv. 95; *De Candolle Prodr.* xvi. pt. ii. 500. — Boissier, *Fl. Orient.* v. 711. — Franchet, *Nouv. Arch. Mus.* sér. 2, v. 293 (*Pl. David.* i.). — Conwentz, *Abhand. Landesk. Prov. Westpreussen*, iii. 1, t. 1, 2 (*Die Eibe in Westpreussen*). — Hempel & Wilhelm, *Bäume und Sträucher*, i. 198, f. 117, 118, t. 11.

Taxus lugubris, Salisbury, *Prodr.* 396 (1796).

Taxus nucifera, Wallich, *Tent. Fl. Nepal.* 57, t. 44 (not Linnæus) (1826).

Taxus polyplœa, Spadoni, *Xilolog.* iii. 195 (1828).

Taxus Wallichiana, Zuccarini, *Abhand. Akad. Münch.* iii. 803, t. 5 (*Beitr. Morphologie der Coniferen*) (1837–43).

? Taxus baccata, var. *microcarpa*, Maximowicz, *Mém. Sav. Étr. Acad. Sci. St. Pétersbourg*, ix. 259 (*Prim. Fl. Amur.*) (1859).

Taxus orientalis, Bertoloni, *Misc. Bot.* xxiv. 17, t. 2 (1862).

Taxus baccata, which usually grows in shady situations on the northern slopes of hills or under the shade of deciduous-leaved trees, and is rarely gregarious, sometimes attains a height of a hundred feet, with a tall straight trunk five or six feet in diameter, but is usually much smaller and of a bushy habit; it is widely distributed over western and central Europe and the mountains of southern Europe and northern Africa, reaching southern Scandinavia on the north, and ranging through western Asia to the temperate Himalayas, where it is common, especially in the northwest provinces, up to elevations of 10,000 or 12,000 feet above the sea-level and probably attains its largest size, and to northern China and Manchuria.

The wood of *Taxus baccata* is strong and hard, with a fine close grain, and is flexible, elastic, and easy to split; it is of a handsome orange-red or dark red-brown color, with thin almost white sapwood, and is little affected by contact with the soil or atmosphere. From the time of the ancients the wood of *Taxus baccata* has been valued in the manufacture of bows, which, for centuries after the Anglo-Saxon conquest, were the principal weapons of the English, and before the introduction of firearms Yew wood was largely imported into England from southern Europe. (See Hansard, *The Book of Archery*, 325.) The wood is considered more valuable than that of any other European tree for cabinet-making, and is largely used for this purpose in the form of veneers; it is also made into boxes, vases, musical instruments, and whip handles, and is employed for fence-posts, stakes, and palings.

In some of the districts of northwestern India the Yew is venerated, and its wood is burned as incense; in other parts of India its branches are sometimes carried in religious processions, and are used for the decoration of houses during religious festivals. The powdered bark is mixed with tea, and is employed as a red dye; it is sometimes utilized in the treatment of rheumatism; and the powdered leaves are used as a tonic and as an expectorant in the treatment of catarrh. The sweet covering of the seed is eaten by the mountaineers of northwestern India, and domestic animals browse on the leaves and branches. (See Brandis, *Forest Fl. Brit. Ind.* 541. — Gamble, *Man. Indian Timbers*, 413. — Balfour, *Cyclopædia of India*, ed. 3, iii. 827.)

Of slow growth, *Taxus baccata* attains a great age, and the oldest trees in Europe are believed to be Yew-trees, which appear occasionally to live under favorable conditions for more than a thousand years. (See De Candolle, *Bibl. de Genève*, xlvii. 30 [*Notice sur la Longévité des Arbres*]. — Bowman, *Mag. Nat. Hist.* n. ser. i. 28, 85.) In England Yew-trees have been planted for centuries in the neighborhood of churches or have influenced the selection of their sites, and some of these venerable Yews with enormous stems and broad picturesque heads of dark foliage were ancient trees when Columbus was born. (See Strutt, *Sylva Britannica*, 12, t. 21. — Bree, *Mag. Nat. Hist.* vi. 47, f. — Loudon, *Arb. Brit.* iv. 2073. — Selby, *Brit. Forest Trees*, 368.)

During the seventeenth century Yew-trees, which can endure an annual shortening of the branches, were cut into all sorts of fantastic shapes to decorate the gardens of France, England, and Holland, and were largely employed in forming hedges, for which purpose they are admirably adapted and still frequently used.

In the eastern United States *Taxus baccata* flourishes south of Cape Cod, and was probably introduced early in the eighteenth century, as large specimens are not uncommon in the neighborhood of New York, Philadelphia, and Baltimore.

A number of abnormal forms of *Taxus baccata* have appeared. The most distinct of them is the Florence Court or Irish Yew (*Taxus baccata fastigiata*, Loudon, *l. c.* 2066, f. 1981 [1838]), distinguished by its upright branches and its larger leaves, which are spirally disposed and not distichous, as in the common form. The plants of this variety are all female, and have been propagated from one of two trees found during the last century on the mountains of County Fermanagh, in Ireland, and planted in the garden of Florence Court, a seat of the Earl of Enniskillen. (See *Gard. Chron.* 1873, 1336.)

Taxus baccata Dovastonii (Carrière, *Rev. Hort.* 1861, 175, f.), distinguished by its long pendulous branchlets and by the color and size of its leaves, which are longer and darker than those of the type, was purchased as a seedling from a peddler and planted by Mr. John Dovaston about one hundred and twenty years ago in his garden in Westfelton, near Shrewsbury, in England. It is a handsome ornamental tree, now common in gardens. (See Loudon, *l. c.* 2068, f. 1990.)

A dwarf Yew (*Taxus baccata adpressa*, Carrière, *Traité Conif.* 520 [1855]), with numerous spreading branches, distinguished by its short broad leaves, and known in plants of one sex only, is also frequently cultivated. Its origin has not been determined, but, although believed at one time to have been introduced from China or Japan, it is more probably a seedling form of *Taxus baccata* raised in some European nursery. Other seedling forms of dwarf or otherwise unusual habit, or with yellow or silvery leaves, are common in cultivation, and are prized by the admirers of abnormal plant-forms. (See Carrière, *l. c.* ed. 2, 731. — Gordon, *Pinetum*, ed. 2, 388. — Veitch, *Man. Conif.* 301. — Beissner, *Handb. Nadelh.* 169.)

[2] *Taxus cuspidata*, Siebold & Zuccarini, *Abhand. Akad. Münch.* iv. pt. ii. 232 (1846); *Fl. Jap.* ii. 62, t. 128. — Endlicher, *Syn. Conif.* 243. — Miquel, *Ann. Mus. Lugd. Bat.* iii. 169 (*Prol. Fl. Jap.*). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 502. — Franchet & Savatier, *Enum. Pl. Jap.* i. 472. — Masters, *Jour. Linn. Soc.* xviii. 499 (*Conifers of Japan*). — Miyabe, *Mem. Bost. Soc. Nat. Hist.* iv. 261 (*Fl. Kurile Islands*).

the genus is represented by a shrub[1] of the northern Atlantic region, by a small shrubby tree of western Florida, by a tree of the Pacific region, and by a little known species endemic in Mexico.[2] The genus is an ancient one, its fossil remains attesting the fact that Yew-trees have existed since miocene times.[3]

Taxus produces wood valued in the arts. The leaves and seeds contain taxine, an alkaloid to which actively poisonous properties are ascribed,[4] and the bark is rich in tannin. Several of the species have long been planted for the adornment of parks and gardens.

In North America Taxus is not injured by insects, and has no serious fungal enemies.[5]

The different species can be propagated by seeds, and the varieties and abnormal forms multiplied by cuttings.

The generic name, from Τάξος, is the classical name for the Yew-tree.

Taxus baccata, Thunberg, *Fl. Jap.* 275 (not Linnæus) (1784).

Taxus baccata cuspidata, Carrière, *Traité Conif.* ed. 2, 733 (1867). — Beissner. *Handb. Nadelh.* 173.

Taxus cuspidata inhabits Manchuria, Corea, and the island of Yezo, where, although not common, it is widely scattered through the forests of deciduous-leaved trees, often rising to a height of fifty feet, and forming a tall straight trunk frequently two feet in diameter. The wood, which resembles that of *Taxus baccata*, is used by the Ainos for their bows, and is also employed in cabinet-making and for the interior decoration of expensive houses. (See Sargent, *Forest Fl. Jap.* 76.)

Taxus cuspidata is often used to decorate Japanese gardens, where it is frequently cut into fantastic shapes. It was introduced into the gardens of the eastern United States in 1862 through the agency of the Parsons' nursery at Flushing, New York, and is perfectly hardy as far north at least as eastern Massachusetts, growing in cultivation more rapidly than other Yew-trees, and promising to become a valuable decorative plant in the northern states. A dwarf form of this species with a more compact and upright habit and shorter leaves, of Japanese origin, and now common in American gardens, is evidently a seminal variety, and probably, in part at least, the *Taxus tardiva* of Parlatore (*De Candolle Prodr.* xvi. pt. ii. 502 [1868]).

[1] *Taxus Canadensis*, Marshall, *Arbust. Am.* 151 (1785). — Willdenow, *Spec.* iv. pt. ii. 856. — Pursh, *Fl. Am. Sept.* ii. 647. — Bigelow, *Fl. Boston.* ed. 3, 399. — Emerson, *Trees Mass.* 111 ; ed. 2, i. 127. — Darlington, *Fl. Cestr.* ed. 3, 296. — Parlatore, *l. c.* 501. — Watson & Coulter, *Gray's Man.* ed. 6, 494.

Taxus baccata, β *minor*, Michaux, *Fl. Bor.-Am.* ii. 245 (1803).

Taxus baccata, β, Hooker, *Fl. Bor.-Am.* ii. 167 (in part) (1839).

Taxus baccata, var. *Canadensis*, Gray, *Man.* ed. 2, 425 (1856). — Macoun, *Cat. Can. Pl.* 463.

Taxus minor, Britton, *Mem. Torrey Bot. Club*, v. 19 (1893).

Taxus Canadensis is a shrub with prostrate wide-spreading branches and a stem occasionally one or two feet in height ; it is a common inhabitant of northern woods, often forming under their dense shade in low rich soil broad masses or sometimes nearly impenetrable thickets, and is distributed from Newfoundland to the northern shores of Lake Superior and to those of Lake Winnipeg, and southward through the northern states to New Jersey and Minnesota.

[2] *Taxus globosa*, Schlechtendal, *Linnæa*, xii. 496 (1838). — Endlicher, *Syn. Conif.* 244. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 227. — Carrière, *l. c.* 524. — Parlatore, *l. c.* — Hemsley, *Bot. Biol. Am. Cent.* iii. 185.

This south-Mexican species, which is described as a small tree, has not been seen by any of the botanists who have lately visited Mexico, and is very imperfectly known.

[3] Saporta, *Origine Paléontologique des Arbres*, 59. — Zittel, *Handb. Palæontolog.* ii. 256.

[4] No cases of poisoning by Taxus in North America appear to be recorded, and in India domestic animals are said to browse upon *Taxus baccata* without experiencing any bad effects (Brandis, *Forest Fl. Brit. Ind.* 541). On the other hand, Taxus has been credited in Europe with toxic properties since the time of the Greeks, and numerous instances are cited of fatal results following the medicinal use of the leaves, and of the death of animals fed upon them. Other cases, however, are reported of animals, gradually accustomed to a diet of Yew, being nourished on the branches without bad effects. The sweet pulpy covering of the seed is palatable to most people, and is not poisonous, although often believed to be so, and flour made from the seeds is used to fatten poultry. (See Loudon, *Arb. Brit.* iv. 2089. — Marmé, *Liebig's Annalen*, cxxv. 71. — Redwood, *Pharm. Jour. Trans.* ser. 3, viii. 36. — Amato & Capparelli, *Gazzetta di Chimica*, x. 349. — Johnson, *Man. Med. Bot. N. Am.* 262. — Cornevin, *Plantes Vénéneuses*, 43. — *Pharmacographia Indica*, vi. 373. — Hilger & Brande, *Berichte der deutsch. Chem. Gesell.* xxiii. 464. — *U. S. Dispens.* ed. 16, 1933.)

[5] *Leptosphæria taxicola*, Saccardo, and *Diplodea Taxi*, De Notaris, two minute fungi, have been noticed on *Taxus Canadensis*.

CONSPECTUS OF THE ARBORESCENT SPECIES OF THE UNITED STATES.

Leaves short, yellow-green . . . . . 1. T. BREVIFOLIA.
Leaves elongated, usually falcate, dark green . . . . . 2. T. FLORIDANA.

TAXUS BREVIFOLIA.

Yew.

LEAVES short, yellow-green.

Taxus brevifolia, Nuttall, *Sylva*, iii. 86, t. 108 (1849). — Torrey, *Pacific R. R. Rep.* iv. pt. v. 140. — Newberry, *Pacific R. R. Rep.* vi. 60, 90, f. 26. — Cooper, *Pacific R. R. Rep.* xii. pt. ii. 26, 69; *Am. Nat.* iii. 414. — Carrière, *Traité Conif.* ed. 2, 742. — Hoopes, *Evergreens*, 383. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 501. — K. Koch, *Dendr.* ii. pt. ii. 95. — Gordon, *Pinetum*, ed. 2, 392. — Hall, *Bot. Gazette*, ii. 95. — Brewer & Watson, *Bot. Cal.* ii. 110. — Veitch, *Man. Conif.* 305. — Kellogg, *Forest Trees California*, 6. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 185. — Lemmon, *Rep. California State Board Forestry*, iii. 185, t. 30 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 83. — Beissner, *Handb. Nadelh.* 177. — Masters, *Jour. R. Hort. Soc.* xiv. 249. — Hansen, *Jour. R. Hort. Soc.* xiv. 312 (*Pinetum Danicum*).

Taxus baccata, Hooker, *Fl. Bor.-Am.* ii. 167, in part (not Linnæus) (1839).

Taxus Boursieri, Carrière, *Rev. Hort.* 1854, 228, t.; *Traité Conif.* 523. — Lauche, *Deutsche Dendr.* ed. 2, 47.

Taxus Lindleyana, A. Murray, *Edinburgh New Phil. Jour.* n. ser. i. 294 (1855); *Trans. Bot. Soc. Edinburgh*, vi. 370. — Carrière, *Traité Conif.* 523. — Gordon, *Pinetum*, 316; Suppl. 99. — Henkel & Hochstetter, *Syn. Nadelh.* 360. — (Nelson) Senilis, *Pinaceæ*, 174.

Taxus baccata, var. **Canadensis**, Bentham, *Pl. Hartweg.* 338 (not Gray) (1857).

Taxus Canadensis, J. M. Bigelow, *Pacific R. R. Rep.* iv. pt. v. 25 (not Marshall) (1856).

Taxus baccata, var. *a* **brevifolia**, Koehne, *Deutsche Dendr.* 6 (1893).

A tree, usually forty or fifty, but occasionally seventy or eighty feet in height, with a tall straight trunk one or two or rarely four and a half feet thick, frequently unsymmetrical, with one diameter much exceeding the other, and irregularly lobed with broad rounded lobes, and long slender horizontal or slightly pendulous branches, which form a broad open conical head. The bark of the trunk is about a quarter of an inch in thickness, and covered with small thin dark red-purple scales, which, in falling, disclose the brighter red-purple inner bark. The branchlets are slender, and in their fourth or fifth year turn bright cinnamon brown. The buds are from one sixteenth to nearly one eighth of an inch in length, with loosely imbricated pale yellow-green scales. The leaves are from one half to five eighths of an inch long and about one sixteenth of an inch wide, dark yellow-green above and rather paler below, with stout midribs, and slender yellow petioles one twelfth of an inch in length, and remain on the branches four or five years.

Taxus brevifolia inhabits the shady banks of mountain streams, deep gorges, and damp ravines, growing usually under larger coniferous trees; although nowhere abundant or gregarious, it is widely distributed, usually in single individuals or in small clumps, from Queen Charlotte's Islands and the valley of the Skeena River southward through the coast ranges of British Columbia,[1] through western Washington and Oregon, where it attains its greatest size, and the coast-ranges of California, as far south as the Bay of Monterey, and along the western slopes of the Sierra Nevada, where it is found at elevations of between five and eight thousand feet above the sea-level, to Tulare County, and ranges eastward in British Columbia to the Selkirk Mountains and over the mountains of eastern Oregon and Washington to the western slopes of the Rocky Mountains of Montana, being of smaller size in the interior than near the coast, and often shrubby in habit.

The wood of *Taxus brevifolia* is heavy, hard, strong, although brittle, close-grained, very durable in contact with the soil, and susceptible of receiving a beautiful polish. It is light bright red, with thin light yellow sapwood, and contains thin dark-colored conspicuous bands of small summer cells and

[1] G. M. Dawson, *Can. Nat.* n. ser. ix. 329. — Macoun, *Cat. Can. Pl.* 436.

many thin obscure medullary rays. The specific gravity of the absolutely dry wood is 0.6391, a cubic foot weighing 39.83 pounds.[1] It is used for fence-posts and by the Indians of the northwest coast for paddles, spear-handles, bows, fish-hooks, and other small articles.

Taxus brevifolia was discovered on the lower Columbia River by David Douglas[2] in 1825, and was introduced in 1854 by Mr. William Lobb into European gardens, where it is occasionally cultivated.

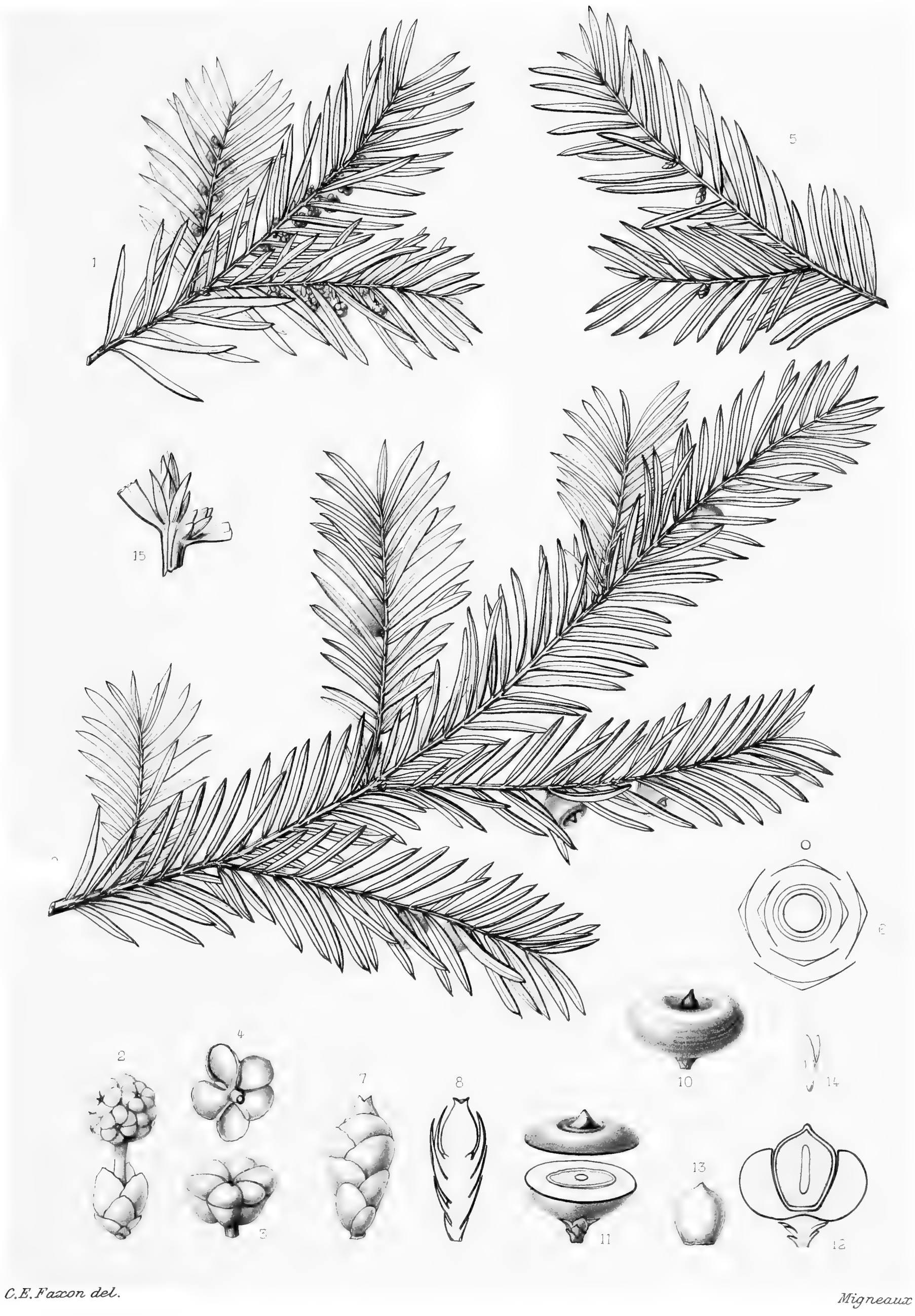
[1] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is eighteen inches and three quarters in diameter inside the bark, and shows one hundred and eighty-seven layers of annual growth.

[2] See ii. 94.

EXPLANATION OF THE PLATE.

PLATE DXIV. TAXUS BREVIFOLIA.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, enlarged.
4. A stamen, seen from below, enlarged.
5. A flowering branch of the pistillate tree, natural size.
6. Diagram of a pistillate flower.
7. A pistillate flower with its scales, enlarged.
8. Vertical section of a pistillate flower, enlarged.
9. A fruiting branch, natural size.
10. A fruit, enlarged.
11. A fruit divided transversely, enlarged.
12. Vertical section of a fruit, enlarged.
13. A seed, enlarged.
14. An embryo, much magnified.
15. A winter-bud, enlarged.



C.E. Faxon del. *Migneaux sc.*

TAXUS BREVIFOLIA, Nutt.

A. Riocreux direx.t. *Imp. J. Taneur, Paris.*

TAXUS FLORIDANA.

Yew.

LEAVES elongated, usually falcate, dark green.

Taxus Floridana, Chapman, *Fl.* 436 (1860). — Carrière, *Traité Conif.* ed. 2, 741. — Hoopes, *Evergreens*, 384. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 186.

A bushy tree, rarely twenty-five feet in height, with a short trunk, occasionally a foot in diameter, and numerous stout spreading branches; or more often shrubby in habit, and twelve or fifteen feet tall. The bark of the trunk is an eighth of an inch in thickness, dark purple-brown, smooth and compact, occasionally separating into large thin irregular plate-like scales. The branchlets are slender and light yellow-green, and in their second or third year turn dark dull brown tinged with red. The buds are about one sixteenth of an inch long, and covered with loosely imbricated pale yellow scales. The leaves are usually conspicuously falcate, from three quarters of an inch to nearly an inch in length, from one sixteenth to one twelfth of an inch in width, dark green above and pale below, with rather obscure midribs, and slender petioles nearly one sixteenth of an inch long. The flowers appear in March and April, and the fruit, which is very sparingly produced, ripens in October.[1]

Taxus Floridana, growing with *Tumion taxifolium*, inhabits the bluffs and ravines of the eastern bank of the Appalachicola River in Gadsden County, western Florida, where it is distributed from Aspalaga to the neighborhood of Bristol, a distance of about thirty miles, and eastward to the woody borders of Flat Creek, six miles from Aspalaga.

The wood of *Taxus Floridana* is heavy, hard, and very close-grained. It is dark brown tinged with red, with thin nearly white sapwood, and contains thin dark-colored inconspicuous bands of small summer cells and numerous obscure medullary rays. The specific gravity of the absolutely dry wood is 0.6340, a cubic foot weighing 39.51 pounds.[2]

Taxas Floridana was discovered near Aspalaga in 1833 by Mr. Hardy B. Croom.[3] One of the rarest of the trees of North America, and, except by its habit, not easily distinguishable from the northern *Taxus Canadensis*, it is still untried in gardens.[4]

[1] Ripe fruit of *Taxus Floridana* was first collected by Dr. Charles Mohr in October, 1895. The pistillate flowers were gathered by W. M. Canby and C. S. Sargent, March 16, 1890.

[2] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is three inches and three quarters in diameter inside the bark, and has two hundred and seventy-five layers of annual growth, five of which are of sapwood.

[3] The first notice of this tree, without description or specific name, was published in 1834 in the *American Journal of Science* (xxvi. 314) by Mr. Croom, who considered it probably identical with the European Yew. It was next mentioned by Nuttall in 1849 (*Sylva*, iii. 92), who doubtfully attached to it the name of *Taxus montana*, although Croom's specimen in the herbarium of the Philadelphia Academy was, he says, marked *Taxus Floridana*, the name adopted by Chapman when the species was finally described in 1860.

[4] During the winter of 1896 living plants of *Taxus Floridana* have been introduced into Mr. George W. Vanderbilt's Arboretum on his estate of Biltmore in North Carolina.

EXPLANATION OF THE PLATE.

Plate DXV. Taxus Floridana.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, enlarged.
4. A stamen, basal view, two of the cells open, enlarged.
5. A pistillate flower, enlarged.
6. Vertical section of a pistillate flower, enlarged.
7. A fruiting branch, natural size.
8. A half-grown fruit, enlarged.
9. Vertical section of a fruit, enlarged.
10. A leaf divided transversely, upper surface, enlarged.

C.E.Faxon del. Rapine sc.

TAXUS FLORIDANA, Chapm.

A. Riocreux direx.t Imp. J. Taneur, Paris.

JUNIPERUS.

Flowers naked, usually diœcious, axillary or terminal, the staminate with numerous stamens verticillate or opposite on a central axis; anther-cells 2 to 6; the pistillate of numerous scales bearing 1 or 2 erect ovules. Fruit a fleshy strobile. Leaves binate or ternate, subulate or scale-like, often of two forms on the same plant, persistent.

Juniperus, Linnæus, *Gen.* 311 (1737). — Adanson, *Fam. Pl.* ii. 481. — A. L. de Jussieu, *Gen.* 413. — Endlicher, *Gen.* 258. — Meisner, *Gen.* 352. — Bentham & Hooker, *Gen.* iii. 427. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 101. — Baillon, *Hist. Pl.* xii. 38. — Masters, *Jour. Linn. Soc.* xxx. 12.

Sabina, Haller, *Ruppius Fl. Jen.* ed. 2, 336 (1745).

Thuiæcarpus, Trautvetter, *Pl. Imag. Fl. Russ.* 11, t. 6 (1844).

Arceuthos, Antoine & Kotschy, *Oestr. Bot. Wochenbl.* 1854, 249.

Pungent-aromatic trees or shrubs, with thin shreddy, or rarely thick bark broken into oblong plates, soft close-grained durable fragrant wood, slender branches, scaly or naked buds, and fibrous roots. Leaves sessile, entire or denticulate, convex on the lower surface, concave and stomatiferous above, persistent for many years, linear-subulate, disposed in whorls of threes, free and jointed at the base, sharp-pointed, eglandular, channeled and white-glaucous above (Caryocedrus, Oxycedrus), or opposite and decussate or ternate, scale-like, closely imbricated, more or less appressed and adnate to the branch, frequently glandular-pitted on the back, on young plants or vigorous shoots often free and acicular, dying and becoming brown and woody on the branch (Sabina). Flowers minute, diœcious or very rarely monœcious, axillary or terminal on short axillary branches, opening from buds formed in the autumn on branches of the year. Staminate flower solitary, or rarely capitate in a three to six-flowered head (Arceuthos), oblong-ovate, composed of a slender sessile or stipitate axis bearing numerous crowded or remote decussately opposite or ternate stamens; filaments short, enlarged into ovate or peltate scale-like light yellow connectives, entire or denticulate, bearing on the inner face near the base from two to six globose two-valved cells opening longitudinally; pollen-grains simple. Pistillate flower ovoid, composed of from three to six opposite or ternate ovate pointed fleshy scales alternate with or bearing on the inner face at the base on a minute ovuliferous scale one or two erect free orthotropous ovules, and subtended by numerous minute scale-like bracts persistent and unchanged under the fruit. Fruit a berry-like short-stalked strobile ripening during the first or second or rarely the third autumn, formed by the coalition of the flower scales, blue, blue-black, or reddish, inclosed in a thick close or loose membranaceous epidermis covered with a glaucous bloom, smooth or marked with the points and margins of the scales of the flower, or with the pointed tips of the ovules, closed, or rarely open and exposing the seeds at the apex; flesh succulent and juicy, penetrated by numerous large or small irregularly shaped resin glands, in one group becoming sweet, dry, and fibrous by the absorption or change of the fragrant resin. Seeds from one to twelve, ovate, acute or obtuse, terete or variously angled by mutual pressure, often longitudinally grooved by depressions caused by the pressure of the resin-cells of the pericarp, smooth, roughened or tuberculate, brown and lustrous above, marked below with large conspicuous usually bilobed hilums, free, or united into a thick globose woody stone-like mass separated into distinct one-seeded nutlets (Caryocedrus); seed-coat of two layers, the outer thick, indurate or bony, the inner thin, membranaceous or crustaceous.

Embryo terete, straight, axile in fleshy albumen; cotyledons two or rarely five or six, the radicle superior.[1]

Juniperus is confined to the northern hemisphere, where it is widely scattered from the Arctic Circle to the highlands of Mexico, Lower California, and the West Indies in the New World, and to the Azores and Canary Islands, northern Africa, Abyssinia, and the mountains of east tropical Africa, Sikkim, and the mountains of southern Japan in the Old World. From thirty to thirty-five species are now distinguished;[2] of these ten inhabit the United States; one is endemic in Mexico;[3] one occurs on the islands of Lower California[4] and another in Bermuda and the Antilles;[5] in the Old World the largest number of species are found in the Mediterranean Basin;[6] the genus has several representatives in the Atlantic Islands,[7] and one in east tropical Africa;[8] one endemic species[9] inhabits the Himalayas,

[1] By Endlicher (*Syn. Conif.* 8 [1847]) the species of Juniperus are grouped in the following sections: —

CARYOCEDRUS. Staminate flowers in 3 to 6-flowered heads, spreading after anthesis, their axes stipitate; stamens 9 to 12, their connections ovate acute, incurved at the apex. Seeds joined into a thick globose woody 3-angled mass. Leaves acicular.

OXYCEDRUS. Flowers axillary; staminate flower solitary, its axis stipitate, the stipe clothed with minute scale-like bracts; stamens opposite, decussate; anther-cells prominent, subdorsal; ovules three, alternate with the inner scales of the flower, their enlarged stigma-shaped tips persistent on the fruit. Seeds free, usually 3, or fewer by abortion. Leaves ternate, linear, acicular, free and jointed at the base, eglandular, channeled and white-glaucous on the upper surface. Buds scaly.

SABINA. Flowers terminal on short axillary branches; staminate flower solitary; anther-cells basal; stamens ternate or opposite. Seeds 1 to 12, free. Leaves ternate or opposite, mostly adnate and scale-like, closely appressed, crowded and adnate on the branches, glandular or eglandular on the back, or on vigorous branches and young plants free and acicular.

[2] Spach, *Ann. Sci. Nat.* sér. 2, xvi. 282 (*Révision des Juniperus*). — Endlicher, *Syn. Conif.* 7. — Antoine, *Cupressineen-Gattungen.* — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 475.

[3] *Juniperus gigantea*, K. Koch, *Berl. Allg. Gartenzeit.* 1858, 341.

Juniperus Mexicana, Schlechtendal, *Linnæa*, v. 77 (not Sprengel) (1830); xii. 494. — Parlatore, *l. c.* 491. — Engelmann, *Trans. St. Louis Acad.* iii. 589. — Hemsley, *Bot. Biol. Am. Cent.* iii. 184.

Sabina gigantea, Antoine, *l. c.* 36, t. 48, 50, f. E–L (1857).

Sabina Mexicana, Antoine, *l. c.* 38, t. 51, 55 f. A–D (1857).

This species, which appears to be common on the mountains of northeastern Mexico, is also abundant on the high plains lying inland from the mountain chain dominated by Mt. Orizaba in the state of Vera Cruz, flourishing in arid sterile calcareous soil, and varying in size from a broad low-branched shrub to a handsome shapely tree of medium size (C. G. Pringle, in litt.).

[4] *Juniperus Cerrosiana*, Kellogg, *Proc. Cal. Acad.* ii. 37 (1863). — M. K. Curran, *Bull. Cal. Acad.* i. 147. — Greene, *Pittonia*, i. 197, 207.

? *Juniperus Californica*, var. *osteosperma*, Watson, *Proc. Am. Acad.* xi. 119 (1876). — Lemmon, *West-American Cone-Bearers*, 79.

This bushy tree, with large blue-black fruit containing three or four seeds, has given its name to Cerros Island, off the coast of Lower California. It is probably also the species of Guadaloupe Island of the same region, where a low Juniper covers the ravines and valleys in the central and southern part of the island.

[5] *Juniperus Bermudiana*, Linnæus, *Spec.* 1039 (1753). — Willdenow, *Spec.* iv. pt. ii. 851. — *Nouveau Duhamel*, vi. 50. — Lunan, *Hort. Jam.* i. 83. — Maycock, *Fl. Barb.* 394. — Hooker, *Lond. Jour. Bot.* ii. 141, t. 1. — Lefroy, *Bull. U. S. Nat. Mus.* No. 25, 108 (*Bot. Bermuda*).

Juniperus Barbadensis, Linnæus, *l. c.* (1753). — Willdenow, *l. c.* — Maycock, *l. c.* — Grisebach, *Fl. Brit. W. Ind.* 503.

Juniperus oppositifolia, Moench, *Meth.* 698 (1794).

Juniperus pyramidalis, Salisbury, *Prodr.* 397 (1796).

Sabina Bermudiana, Antoine, *l. c.* 65, t. 87, 88, f. A–D (1857).

Biota Meldensis, Gordon, *Pinetum*, 37 (1858); ed. 2, 57.

Juniperus Bermudiana, which is said to attain a large size on the mountains of Jamaica and on several of the other West Indian islands, is the most abundant and conspicuous tree of the Bermuda group, growing everywhere on the poor dry limestone hills, and in the brackish swamps common on some of the islands. It is a bushy tree, with stout tough spreading branches and pale blue-green leaves glandular on the back, and is occasionally forty or fifty feet in height, with an irregularly lobed trunk five or six feet in diameter, although individuals of this size are now rare, nearly all the large trees having been cut for timber. The wood is very durable, dark red-brown with thin nearly white sapwood and a close compact surface capable of receiving a beautiful polish. Formerly it was largely used on the islands for shipbuilding, for the interior finish of houses, and in cabinet-making. (See *Garden and Forest*, iv. 289, f. 51, 52.)

[6] Desfontaines, *Fl. Atlant.* ii. 370. — Brotero, *Fl. Lusitan.* i. 126. — Sibthorp & Smith, *Fl. Græc. Prodr.* ii. 262. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 21. — Parlatore, *Fl. Ital.* iv. 75. — Laguna, *Fl. Forestal Española*, i. 96. — Boissier, *Fl. Orient.* v. 705.

[7] Link, *Buch Phys. Beschr. Canar. Ins.* 159. — Webb & Berthelot, *Phytogr. Canar.* sect. iii. 277.

[8] *Juniperus procera*, Endlicher, *l. c.* 26 (1847). — A. Richard, *Tent. Fl. Abyss.* ii. 278. — Parlatore, *l. c.* 485. — Oliver, *Jour. Linn. Soc.* xxi. 404.

Sabina procera, Antoine, *l. c.* 36, t. 47 (1857).

[9] *Juniperus recurva*, D. Don, *Prodr. Fl. Nepal.* 55 (1825). — Parlatore, *l. c.* 481. — Boissier, *l. c.* 708. — Hooker f. *Fl. Brit. Ind.* v. 647.

Sabina religiosa, Antoine, *l. c.* 47, t. 61, 62, f. C, B (1857).

Sabina recurva, Antoine, *l. c.* 67, t. 88, f. E–M; t. 90, 91 (1857).

Sabina recurva, var. α *tenuifolia*, Antoine, *l. c.* t. 88, f. N, t. 92 (1857).

Sabina recurva, var. β *densa*, Antoine, *l. c.* (1857).

Juniperus recurva is a tree twenty or thirty feet in height, with a conical crown of graceful pendulous branches (see figure in Hooker f. *Himalayan Journals*, ii. 51), which, at high elevations, becomes

in whose forests Juniperus has four representatives, and in eastern Asia five or six species are widely distributed.[1] One of the endemic species of North America crosses the continent, another is confined to western Texas and the adjacent portions of Mexico, and the remainder belong to the forests of the Rocky Mountains and the Pacific side of the continent. Two species common to both hemispheres extend at the north across the continent, one of them a small tree and the other, in its American form, a prostrate shrub.[2] Impressions of Juniperus found in the tertiary rocks of Europe, although not abundant, indicate that the genus, nearly in its present form, has long inhabited the earth.[3]

The close-grained durable fragrant wood of Juniperus is used for posts, in construction, and in the manufacture of many small articles, the most valuable timber-trees of the genus being the North American *Juniperus Virginiana* and the Asiatic *Juniperus excelsa*;[4] and the bark of many of the

stunted, and assumes a decumbent or prostrate habit. It is then the: —

var. *squamata*, Parlatore, *De Candolle Prodr.* xvi. pt. ii. 482 (1868). — Hooker f. *Fl. Brit. Ind.* v. 647.

Juniperus squamata, D. Don, *Prodr. Fl. Nepal.* 55 (1825). — Lambert, *Pinus*, ii. 17.

Juniperus excelsa, β *nana*, Endlicher, *Syn. Conif.* 26 (1847).

Sabina squamata, Antoine, *Cupressineen-Gattungen*, 66, t. 89, 90 (1857).

Juniperus densa, Gordon, *Pinetum*, Suppl. 32 (1862).

Juniperus recurva is distributed over high mountain-slopes from Afghanistan to Sikkim and Bhotan, rarely descending below altitudes of seven thousand feet, and often in its prostrate form reaching elevations of fifteen thousand feet. Common as a tree in Sikkim between nine thousand and twelve thousand feet above the sea-level, it is shrubby on the northwestern Himalayas, where it often covers large areas with long decumbent stems running on or just below the surface of the ground, and numerous short erect branches. At high elevations the fragrant red wood is used as fuel. The young branches are employed in distilling spirits, and also for the decoration of temples during religious festivals. The fragrant resinous leaves are used in the manufacture of incense, and are gathered in large quantities in Sikkim and sent to the plains for this purpose. (See Brandis, *Forest Fl. Brit. Ind.* 537. — Gamble, *Man. Indian Timbers*, 412.)

[1] Thunberg, *Fl. Jap.* 264. — Siebold & Zuccarini, *Abhand. Akad. Münch.* iv. 233; *Fl. Jap.* ii. 55. — Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, xii. 230 (*Mél. Biol.* vi. 374). — Miquel, *Ann. Mus. Lugd. Bat.* iii. 167 (*Prol. Fl. Jap.*). — Franchet & Savatier, *Enum. Pl. Jap.* i. 471. — Franchet, *Nouv. Arch. Mus.* sér. 2, v. 291 (*Pl. David.* i.).

[2] *Juniperus Sabina prostrata*, Loudon, *Arb. Brit.* iv. 2498, f. 2361 (1838). — Beissner, *Handb. Nadelh.* 111.

Juniperus Sabina, Michaux, *Fl. Bor.-Am.* ii. 246 (not Linnæus) (1803). — Hooker, *Fl. Bor.-Am.* ii. 166.

Juniperus prostrata, Persoon, *Syn.* ii. 632 (1807). — Richardson, *Franklin Jour.* Appx. No. 7, 753. — Torrey, *Compend. Fl. N. States*, 377. — Carrière, *Traité Conif.* 26. — Gordon, *Pinetum*, 106.

Juniperus Sabina, var. *procumbens*, Pursh, *Fl. Am. Sept.* ii. 647 (1814). — Engelmann, *Trans. St. Louis Acad.* iii. 591. — Macoun, *Cat. Can. Pl.* 463. — Watson & Coulter, *Gray's Man.* ed. 6, 494.

Juniperus repens, Nuttall, *Gen.* ii. 245 (1818).

Cupressus thyoides, Hooker, *l. c.* 165 (not Linnæus) (1839).

Juniperus Sabina, β *humilis*, Hooker, *l. c.* 166 (1839).

Juniperus Hudsonica, Forbes, *Pinetum Woburn.* 208 (1839).

Juniperus Virginiana prostrata, Torrey, *Fl. N. Y.* ii. 235 (1843). — Provancher, *Flore Canadienne*, ii. 559.

Juniperus Virginiana, var. *humilis*, Gray, *Man.* ed. 2, 425 (1856).

Juniperus Sabina (Linnæus, *Spec.* 1039 [1753]), of which the North American plant is considered a prostrate form, is an erect shrub or small bushy tree occasionally twelve or fifteen feet tall, widely spread through central and southern Europe and Siberia, with bitter strong-smelling wood and branchlets. In North America the prostrate form is distributed from southern Maine northward to the shores of Hudson's Bay, and westward in British America from Newfoundland through Quebec and Ontario and across the central prairie region to the summits of the Rocky Mountains, and through northern New England and New York, along the shores of the Great Lakes to northern Minnesota, and over the mountain ranges as far west as the eastern slopes of the Rocky Mountains of Montana.

[3] Saporta, *Origine Paléontologique des Arbres*, 100. — Zittel, *Handb. Palæontolog.* ii. 329, f. 228.

[4] Marschall von Bieberstein, *Beschreib. Länd. Casp. Meer.* 204, Appx. No. 72 (1800); *Fl. Taur.-Cauc.* ii. 425. — Willdenow, *Spec.* iv. pt. ii. 854. — Forbes, *l. c.* 205, t. 64. — Trautvetter, *Pl. Imag. Fl. Russ.* 21, t. 15. — Endlicher, *l. c.* 25. — Parlatore, *l. c.* 484.

Juniperus Sabina, Pallas, *Fl. Ross.* ii. 15 (not Linnæus) (1788).

Juniperus Sabina, var. *excelsa*, Georgi, *Beschreib. Russ. Reichs*, iii. 1358 (1802).

Juniperus fœtida, ε *excelsa*, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 297 (*Révision des Juniperus*) (excl. hab. America) (1841).

Juniperus polycarpos, K. Koch, *Linnæa*, xxii. 303 (1849). — Tchihatcheff, *Asie Mineure*, iii. 492.

Juniperus isophylla, K. Koch, *l. c.* 304 (1849). — Tchihatcheff, *l. c.*

Juniperus Olivieri, Carrière, *l. c.* 57 (1855). — Tchihatcheff, *l. c.* 493.

Sabina excelsa, Antoine, *l. c.* 45, t. 60, 62, f. E–T (1847).

Sabina polycarpos, Antoine, *l. c.* 47, t. 63, 66, f. A–D (1857).

Sabina isophyllos, Antoine, *l. c.* 48, t. 64, 65, 66, f. E–G (1857).

Juniperus macropoda, Boissier, *Fl. Orient.* v. 709 (1884). — Hooker f. *Fl. Brit. Ind.* v. 647. — Beissner, *Handb. Nadelh.* 114.

Juniperus excelsa is distributed from the islands of the Grecian Archipelago over the mountain ranges of Asia Minor, Arabia, and Persia to northwestern India and Thibet, where it inhabits bare arid regions at high elevations, sometimes ascending to 15,000 feet above the sea-level. In habit it varies from a low bush to a tree, which on the Himalayas is sometimes fifty feet in height, with a short gnarled crooked trunk occasionally ten feet in diameter, and an irregular head of short contorted branches. The wood is fra-

species is rich in tannin.[1] The fruits of Juniperus contain an essential aromatic oil; they were used by the Greeks and Romans and by the Arabs in medicine, and are still gathered in Europe, especially in southern France, Italy, and Austria, and employed, generally as an adjuvant to more active medicines, as a diuretic and stimulant; those of *Juniperus communis*, a native of both hemispheres, are used to give the peculiar flavor to gin.[2] Savin oil is distilled from the young tender fragrant branchlets of *Juniperus Sabina*, and is a powerful uterine stimulant employed in medicine;[3] and the ointment of savin is used as a stimulating dressing for wounds and sores.[4] Tar obtained by the destructive distillation of the wood of *Juniperus Oxycedrus*[5] was once utilized in southern Europe in veterinary practice. The large blue fleshy succulent fruits of *Juniperus drupacea*[6] of Asia Minor are edible.

Several of the species of Juniperus are cultivated for the decoration of gardens, and during the eighteenth century were frequently cut into curious and fantastic forms.

In North America the species of insects[7] attacking Juniperus are not numerous, although those

grant, light or dark red, and close-grained; in India it is used in building and in the manufacture of many small articles. It burns quickly, emitting a peculiar odor, and is used as incense and largely for fuel in some of the dry nearly treeless interior valleys. The resinous fruit is employed medicinally, and is also made into incense (Madden, *Jour. Agric. and Hort. Soc. Ind.* iv. pt. iv. 256; vii. pt. ii. 138 [*Himalayan Coniferæ*]. — Brandis, *Forest Fl. Brit. Ind.* 538, t. 68. — Gamble, *Man. Indian Timbers*, 412. — Balfour, *Cyclopædia of India*, ed. 3, ii. 455). In southern Afghanistan it forms nearly pure open forests sometimes of great extent. The soft light wood is used in building and largely for fuel; strips of the thick bark are utilized by the Pathans for roofing their huts. The fruit is used in tanning leather and in the preparation of a spirituous liquor. (See Lace & Hemsley, *Jour. Linn. Soc.* xxviii. 296, 305, 307, 320 [*Veg. Brit. Baluchistan*].)

[1] Trimble, *Garden and Forest*, ix. 162.

[2] *Oleum Juniperi* is of a greenish oily color, with a sweetish resinous flavor; it is stimulant, carminative and diuretic, and is generally combined with more active remedies (Recluz, *Jour. de Pharm.* xiii. 215 [*Note sur les fruits de Genévrier*]. — Nicolet, *Jour. de Pharm.* xvii. 309 [*Essais physiologique et chimique sur les fruits du genre Juniperus*]. — Soubeiran & Capitaine, *Jour. de Pharm.* xxvi. 78 [*Essence de Genièvre*]. — *U. S. Dispens.* ed. 16, 1013). The peculiar flavor and diuretic properties of gin are due to the oil of Juniper berries, and are secured by adding the crushed fruit, usually that of *Juniperus communis*, to undistilled grain spirit, or by allowing the spirit vapor to pass over it before condensation (Spons, *Encyclopædia of the Manufactures, Industrial Arts, and Raw Commercial Products*, i. 22).

[3] Flückiger & Hanbury, *Pharmacographia*, 565. — Johnson, *Man. Med. Bot. N. Am.* 261.

[4] Flückiger & Hanbury, *l. c.* 567.

[5] Linnæus, *Spec.* 1038 (1735). — Desfontaines, *Fl. Atlant.* ii. 370. — De Candolle, *Lamarck Fl. Franç.* ed. 3, iii. 278. — Willdenow, *Spec.* iv. pt. ii. 854. — *Nouveau Duhamel*, vi. 47, t. 15, f. 2. — Visiani, *Fl. Dalmat.* i. 202. — Reichenbach, *Icon. Fl. German.* xi. 6, t. 537. — Antoine, *Cupressineen-Gattungen*, 12, t. 11, f. A–J, t. 12–15. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 22. — Tchihatcheff, *Asie Mineure*, iii. 489. — Parlatore, *Fl. Ital.* iv. 80; *De Candolle Prodr.* xvi. pt. ii. 477. — Laguna, *Fl. Forestal Española*, pt. i. 98, t. 11 in (part). — Boissier, *Fl. Orient.* ii. 707. — Hempel & Wilhelm, *Bäume und Sträucher*, i. 192, f. 112, A, D, E, L, P, Q.

Juniperus macrocarpa, Tenore, *Syll. Fl. Neap.* 483 (in part) (not Sibthorp & Smith) (1831).

Juniperus rufescens. — Endlicher, *Syn. Conif.* 11 (1847). — K. Koch, *Linnæa*, xxii. 302. — Antoine, *l. c.* 18, t. 23–25.

Juniperus Oxycedrus, *α gibbosa*, Antoine, *l. c.* 12, t. 11, f. T–V (1857).

Juniperus rufescens, var. *α Noëi*, Antoine, *l. c.* 18, t. 26 (1857).

Juniperus Oxycedrus is a much-branched shrub common on arid mountain slopes in all the Mediterranean Basin, and distributed from Madeira to Asia Minor, northern Syria, and northern Persia.

Pyroleum cadinum or *huile de cade*, so called from the French name of this Juniper, was popular two centuries ago in southern Europe as an external remedy, chiefly in veterinary practice. (See Olivier des Serres, *Theâtre d'Agriculture*, 941. — Parkinson, *Theatr.* 1033. — Pomet, *Hist. Gen. Drog.* 289.) The *huile de cade* now manufactured in France, and sometimes recommended for the treatment of skin diseases, is of unknown origin (Flückiger & Hanbury, *l. c.* 563).

[6] La Billardière, *Icon. Pl. Syr.* ii. 14, t. 8 (1791). — *Nouveau Duhamel*, vi. 47. — Spach, *Ann. Sci. Nat.* sér. 2, xvi. 289; *Hist. Vég.* xi. 312. — Endlicher, *l. c.* 8. — Tchihatcheff, *Rev. Hort.* 1854, 165, 10; *Asie Mineure*, *l. c.* — Boissier, *l. c.* v. 706.

Arceuthos drupacea, Antoine & Kotschy, *Oestr. Bot. Wochenbl.* 1854, 249; *Conif. Cilic. Taurus*, i. t. 1 to 3. — Antoine, *l. c.* 3, t. 4, 5.

Arceuthos drupacea, var. *α acerosa*, Antoine, *l. c.* t. 1 (1857).

Arceuthos drupacea, var. *β obtusiuscula*, Antoine, *l. c.* t. 2, 3 (1857).

Juniperus drupacea, which is a small shrubby tree, occasionally thirty feet in height, although usually much smaller, is the only species of the section Caryocedrus, distinguished by capitate staminate flowers and united seeds; it is widely distributed through Greece, Asia Minor, and northern Syria, and is common on mountain slopes at elevations of from two to five thousand feet above the sea-level, where it is often gregarious, or is scattered through the forests of Oak or Pine.

[7] Packard (*5th Rep. U. S. Entomolog. Comm.* 1890, 904) records only twenty-two species as having been found on Juniperus in North America, and several of these probably attack only diseased or dead plants. Most of them are uncommon, and borers in the living wood are unknown.

Phlœosinus dentatus, Say, has been found in its larval state as a bark-borer in dead or decaying trees, and in Kansas the beetles are said to do much damage by boring under the bark and by girdling young twigs. The larva of *Callidium antennatum*, Newman, is a common borer under the bark of dead or dying Junipers, which are supposed to be bored also by *Hylotrupes ligneus*, Fabricius.

affecting the trees of the Pacific forests are scarcely known; but the different species, especially *Juniperus Virginiana*, are the hosts of several conspicuous fungi[1] and of peculiar mistletoes.[2]

Juniperus can be raised from seed which require two years for germination, and the varieties can be propagated by grafting.

Juniperus, the classical name of the Juniper, used by the pre-Linnæan botanists, was adopted by Linnæus.

The Bag-worm, *Thyridopteryx ephemeræformis*, Haworth, sometimes strips the trees of their leaves. *Dapsilia rutilana*, Hübner, a web-worm introduced from Europe, injured Junipers on Long Island, New York, in 1877, and has since probably extended its range; and an inch-worm, *Drepanodes varus*, Grote & Robinson, also lives upon the leaves. Other species of Lepidoptera and several Coleoptera are reported as feeding on Junipers, but rarely in sufficient numbers to be injurious; and the larva of a saw-fly has been found on them.

Scale insects occasionally infest Junipers, one of them, *Diaspis Carueli*, Targioni-Tozzetti, sometimes being very abundant and covering the leaves and green twigs with small circular white scales. The fruit is infested at times by small lepidopterous larvæ.

[1] The species of Juniperus in the United States are hosts of a number of striking fungi interesting to mycologists, and of practical significance in horticulture and arboriculture. These fungi belong to the Uredineæ, or Rust family, and are popularly known as Cedar-apples. The plants of this order have usually three different stages, the teleutosporic or final stage, the rust stage, and the cluster-cup, the different stages not always occurring on the same host-plant. Gymnosporangium, the genus to which the Cedar-apples belong, has but two stages, the teleutosporic, which is found only on Cupressineæ, and the cluster-cup or æcidial stage, which is confined to the pomaceous section of the order Rosaceæ. *Juniperus Virginiana* is especially subject to the attacks of Gymnosporangia, five species being found on this host in the United States, while still others are suspected. The common Cedar-apple, *Gymnosporangium macropus*, Link, is a familiar object in the northern states in late spring and early summer, and still earlier in the south. It forms the tufts of bright yellow gelatinous club-shaped masses on the smaller twigs, which are often popularly believed to be the flowers of the tree. They are most apparent after the jelly has been swollen by rain, but in dry weather, when the gelatinous masses are contracted, they are seen to rise from kidney-shaped tumors composed of a spongy hypertrophied tissue of very young twigs. The cluster-cup stage of this fungus, *Æcidium pyratum*, Schweinitz, grows on the leaves of cultivated Apple-trees and on those of the wild Crab, *Pyrus coronaria*. The species is common from Maine to Mississippi, and occurs, although less frequently, as far west as Kansas. It is a source of danger to Apple-orchards in the vicinity of Juniper-trees.

A similar but smaller and more compact Cedar-apple on *Juniperus Virginiana* is *Gymnosporangium globosum*, Farlow, whose cluster-cups are also found on apple-leaves and on those of *Pyrus Americana* and *Cratægus tomentosa*. *Gymnosporangium clavipes*, Cooke & Peck, a smaller species, is mainly confined to the branches of *Juniperus Virginiana* and *Juniperus communis*, which it does not distort to any great extent. Its cluster-cup is the brilliant *Rœstelia aurantiaca*, Peck, which attacks the fruit of several species of *Cratægus*, Amelanchier, and cultivated Quinces and Apple-trees. *Gymnosporangium Nidus-avis*, Thaxter, unlike the last species, causes the distortion of both branches and leaves of *Juniperus Virginiana*, and its presence can be recognized from a distance by the bird's-nest-like distortions scattered among the normal branches. In Mississippi *Juniperus Virginiana* is attacked by *Gymnosporangium Bermudianum*, Earle, a species in which both the teleutosporic and cluster-cup stages occur on the Juniper itself. The cluster-cup stage was first observed in Bermuda on *Juniperus Bermudiana*. *Juniperus communis* is also attacked by *Gymnosporangium clavariæforme*, De Candolle, in which the separate masses of jelly somewhat resemble those of *Gymnosporangium macropus*, but are borne directly on the branches, which are not hypertrophied. *Gymnosporangium speciosum*, Peck, occurs on *Juniperus monosperma;* its development has not been observed. See Farlow, *Anniversary Memoirs, Bost. Soc. Nat. Hist.* [*The Gymnosporangia or Cedar-Apples of the U. S.*]).

Besides the Rust fungi, Juniperus is infested by a number of fungi belonging to other orders. The bark of *Juniperus Virginiana* is often whitened in patches by *Corticium acerinum*, var. *niveum*, Thuemen. *Streptothrix atra*, Berkeley & Curtis, is also common on the bark of this tree, as well as *Cenangium deformatum*, Peck.

The leaves of *Juniperus communis* are frequently attacked and killed by *Lophodermium juniperinum*, De Notaris, which, living on their lower surface, form short black oval spots.

[2] In the southern states and territories Junipers are often killed by different species of Phoradendron, which grows on them with the greatest luxuriance, *Phoradendron juniperinum*, Engelmann (*Mem. Am. Acad.* iv. 58 [Gray, *Pl. Fendler.*] [1849]), growing exclusively on these plants in New Mexico, Arizona, and southern California.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

OXYCEDRUS. Flowers axillary, monœcious; stamens decussately opposite; ovules 3, alternate with the scales of the flower, their tips persistent on the fruit; seeds usually 3; leaves ternate, acicular, free and jointed at the base, eglandular.

Fruit subglobose, bright blue covered with a glaucous bloom; leaves spreading, dark yellow-green, channeled and white-glaucous on the upper surface . . . . . 1. J. COMMUNIS.

SABINA. Flowers terminal on short axillary branches; stamens binate or ternate; ovules in the axils of small fleshy scales, often enlarged and conspicuous on the fruit; seeds 1 to 12; leaves ternate or opposite, mostly scale-like, crowded, closely appressed and adnate on the branches, glandular or eglandular on the back, on vigorous shoots and young plants acicular.

Fruit large, reddish brown, with dry fibrous sweet flesh.

Seeds single or few, cotyledons 4 to 6; leaves fringe-margined or denticulate.

Fruit usually oblong; seeds 1 or 2; leaves ternate, rounded at the apex, conspicuously glandular on the back; branchlets stout . . . . . 2. J. CALIFORNICA.

Fruit mostly globose; seeds usually solitary; leaves ternate or binate, acute or acuminate, eglandular; branchlets slender . . . . . 3. J. UTAHENSIS.

Seeds 4 to 12; cotyledons 2; leaves slightly denticulate.

Fruit oblong or globose; seeds 4 to 12; leaves binate, glandular, often slightly spreading at the acute or acuminate apex; branchlets slender . . . . . 4. J. FLACCIDA.

Fruit globose; seeds usually 4; leaves binate, acute, glandular; branchlets slender; bark thick, broken into small oblong plates . . . . . 5. J. PACHYPHLÆA.

Fruit small, blue or blue-black or rarely copper-colored, with juicy resinous flesh; seeds 1 to 4; cotyledons 2.

Leaves ciliate or denticulate.

Fruit large, subglobose or oblong, the flesh filled with large resin glands; seeds 2 or 3; leaves ternate, acute or acuminate, conspicuously glandular; branchlets stout . 6. J. OCCIDENTALIS.

Fruit small, globose or oblong; seeds 1 or rarely 2; leaves acute or acuminate at the apex, usually eglandular; branchlets slender . . . . . 7. J. MONOSPERMA.

Fruit small, globose; seeds 1 to 4; leaves binate, obtuse or rarely acute, closely appressed, carinate, glandular; branchlets slender, sharply quadrangular . . . . 8. J. SABINOIDES.

Leaves entire.

Fruit small, subglobose; seeds 1 to 4; leaves binate, acute, acuminate or rarely obtuse, glandular; branchlets slender . . . . . 9. J. VIRGINIANA.

JUNIPERUS COMMUNIS.

Juniper. Ground Cedar.

FRUIT subglobose, bright blue, covered with a glaucous bloom. Leaves ternate, spreading, dark yellow-green, channeled and white-glaucous on the upper surface.

Juniperus communis, Linnæus, *Spec.* 1040 (1753). — Miller, *Dict.* ed. 8, No. 1. — Muenchhausen, *Hausv.* v. 182. — Du Roi, *Harbk. Baumz.* i. 338. — Evelyn, *Silva*, ed. Hunter, ii. 8. — Lamarck, *Dict.* ii. 625; *Ill.* iii. 416, t. 829. — Pallas, *Fl. Ross.* i. pt. ii. 12, t. 4. — Gærtner, *Fruct.* ii. 62, t. 91. — Woodville, *Med. Bot.* ii. 259, t. 95. — Moench, *Meth.* 699. — Willdenow, *Berl. Baumz.* 158; *Spec.* iv. pt. ii. 853; *Enum.* 1023. — Borkhausen, *Handb. Forstbot.* i. 763. — Georgi, *Beschreib. Russ. Reichs*, iii. 1358. — Smith & Sowerby, *English Bot.* xvi. t. 1110. — Vahl, *Fl. Dan.* vii. t. 1119. — De Candolle, *Lamarck Fl. Franç.* ed. 3, iii. 278. — Michaux, *Fl. Bor.-Am.* ii. 245. — Schkuhr, *Handb.* iii. 287, t. 338. — Brotero, *Fl. Lusitan.* i. 126. — Persoon, *Syn.* ii. 632. — Schlümbach, *Abbild. Nadelbäume*, 94, t. 14. — Marschall von Bieberstein, *Fl. Taur.-Cauc.* ii. 425. — Desfontaines, *Hist. Arb.* ii. 558. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 443. — Wahlenberg, *Fl. Lapp.* 276. — Stokes, *Bot. Mat. Med.* iv. 511. — Nuttall, *Gen.* ii. 245. — *Nouveau Duhamel*, vi. 46, t. 15, f. 1. — Bigelow, *Med. Bot.* iii. 43, t. 44; *Fl. Boston.* ed. 3, 399. — Guimpel, Willdenow & Hayne, *Abbild. Deutsche Holz.* ii. 271, t. 206. — Hayne, *Dendr. Fl.* 205. — Richard, *Comm. Bot. Conif.* 33, t. 5. — Sprengel, *Syst.* iii. 908. — S. F. Gray, *Nat. Arr. Brit. Pl.* ii. 226. — Smith, *English Bot.* iv. 251. — Dietrich, *Forstbot.* i. 128, t. — Hooker, *Fl. Bor.-Am.* ii. 165. — Forbes, *Pinetum Woburn.* 202. — Spach, *Ann. Sci. Nat.* sér. 2, xvi. 289 (*Révision des Juniperus*) (excl. ϵ *macrocarpa*); *Hist. Vég.* xi. 308 (excl. var. ϵ *macrocarpa*). — Roxburgh, *Fl. Ind.* ed. 2, iii. 839. — Visiani, *Fl. Dalm.* i. 206. — Torrey, *Fl. N. Y.* ii. 234. — Schouw, *Ann. Sci. Nat.* sér. 3, iii. 242 (*Conifères d'Italie*). — Emerson, *Trees Mass.* 108; ed. 2, i. 124. — Ledebour, *Fl. Ross.* iii. 684. — Reichenbach, *Icon. Fl. German.* xi. 5, t. 535. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 200. — Carrière, *Traité Conif.* 21. — Turczaninow, *Fl. Baicalensi-Dahurica*, ii. 144. — Antoine, *Cupressineen-Gattungen*, 26, t. 38–40. — Koch, *Syn. Fl. German.* ed. 3, ii. 575. — Gordon, *Pinetum*, 93. — Maximowicz, *Mém. Sav. Étr. Acad. St. Pétersbourg*, ix. 264 (*Prim. Fl. Amur.*). — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 22. — Provancher, *Flore Canadienne*, ii. 559. — Henkel & Hochstetter, *Syn. Nadelh.* 320. — (Nelson) Senilis, *Pinaceæ*, 144. — Tchihatcheff, *Asie Mineure*, iii. 491. — Hoopes, *Evergreens*, 270, f. 34. — Parlatore, *Fl. Ital.* iv. 82; *De Candolle Prodr.* xvi. pt. ii. 479. — Fr. Schmidt, *Mém. Acad. Sci. St. Pétersbourg*, sér. 7. xii. 178 (*Fl. Sachalinensis*). — K. Koch, *Dendr.* ii. pt. ii. 114. — Nördlinger, *Forstbot.* 467, f. — Mathieu, *Fl. Forestière*, ed. 3, 448. — Veitch, *Man. Conif.* 274. — Regel, *Russ. Dendr.* 12. — Masters, *Jour. Linn. Soc.* xviii. 497 (*Conifers of Japan*); *Jour. R. Hort. Soc.* xiv. 212. — Lauche, *Deutsche Dendr.* ed. 2, 57, f. 6. — Laguna, *Fl. Forestal Española*, i. 101, t. 12. — Boissier, *Fl. Orient.* v. 707. — Macoun, *Cat. Can. Pl.* 462. — Schübeler, *Virid. Norveg.* i. 357. — Watson & Coulter, *Gray's Man.* ed. 6, 494. — Hooker, f. *Fl. Brit. Ind.* v. 646. — Beissner, *Handb. Nadelh.* 133, f. 31, 32. — Hansen, *Jour. R. Hort. Soc.* xiv. 290 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 52. — Hempel & Wilhelm, *Bäume und Sträucher*, i. 191, f. 112, B, C, M, R, t. 10, f. 1–6.

Juniperus deformis, Gilibert, *Exercit. Phyt.* ii. 216 (1792).

Juniperus borealis, Salisbury, *Prodr.* 397 (1796).

Juniperus oblonga, Marschall von Bieberstein, *Fl. Taur.-Cauc.* ii. 426 (1808); iii. 634. — Ledebour, *Fl. Ross.* iii. 685. — Antoine, *Cupressineen-Gattungen*, 24, t. 34, 35.

Juniperus communis, α **erecta**, Pursh, *Fl. Am. Sept.* ii. 146 (1814). — K. Koch, *Linnæa*, xxii. 302.

Juniperus hemisphœrica, Presl, *Delic. Prag.* i. 142 (1822). — Tenore, *Syll. Fl. Neap.* 483; *Fl. Nap.* v. 282. — Gussone, *Fl. Sic. Syn.* ii. 634. — Schouw, *Ann. Sci. Nat.* sér. 3, iii. 243 (*Conifères d'Italie*). — Endlicher, *Syn. Conif.* 12. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 200. — Carrière, *Traité Conif.* 17. — Henkel & Hochstetter, *Syn. Nadelh.* 318.

Juniperus repens, Bigelow, *Fl. Boston.* ed. 2, 371 (not Nuttall) (1824).

Juniperus depressa, Rafinesque, *Med. Fl.* ii. 13 (1830).

Juniperus dealbata, Loudon, *Encyclopædia of Trees*, 1090 (1842).

Thuiæcarpus juniperinus, Trautvetter, *Pl. Imag. Fl. Russ.* 11, t. 6 (1844).

Juniperus communis, α **vulgaris**, Endlicher, *Syn. Conif.* 15 (1847).

Juniperus communis, β **Hispanica**, Endlicher, *Syn. Conif.* 15 (1847).

Juniperus communis, γ **Caucasica**, Endlicher, *Syn. Conif.* 16 (1847).

Juniperus communis, δ **arborescens**, Endlicher, *Syn. Conif.* 16 (excl. *Syn.* Loudon) (1847).

Juniperus communis, β **hemisphœrica**, Parlatore, *Fl. Ital.* iv. 83 (1867); *De Candolle Prodr.* xvi. pt. ii. 479.

Juniperus communis, δ **oblonga**, Parlatore, *De Candolle Prodr.* xvi. pt. ii. 479 (1868).

A shrub, with many short slender stems prostrate at the base and then turning upward and forming broad dense mats sometimes fifteen or twenty feet across and three or four feet high; or occasionally tree-like and from twenty to thirty feet in height, with a short eccentric irregularly lobed trunk rarely a foot in diameter, and slender erect branches forming an irregular open head; or at high elevations and in boreal regions prostrate with long decumbent stems.[1] The bark of the trunk is about one sixth of an inch thick and dark reddish brown, separating irregularly into many loose papery persistent scales. The branchlets during their first and second years are slender, smooth and lustrous, and conspicuously three-angled between the short nodes; light yellow tinged with red during their first season, they gradually grow darker and more suffused with red, and in the third season their dark red-brown bark begins to separate into small thin scales. The buds are ovate, acute, about an eighth of an inch long, and loosely covered with scale-like leaves.[2] The leaves are disposed in rather remote ternate whorls, and spread nearly at right angles to the branches; they are linear-lanceolate, acute and tipped with sharp slender rigid cartilaginous points, articulate and truncate at the base, thickened, rounded, obscurely ridged and dark green and lustrous on the back, snowy white and covered with stomata on the upper surface, from one third to one half of an inch long, about one thirty-second of an inch wide, and persistent for many years; they have a strong unpleasant slightly astringent flavor, and during the winter turn a deep rich bronze color on the lower surface. The flowers open late in the spring from buds formed in the autumn in the axils of leaves of the year. The staminate flower, which is about one sixteenth of an inch long, is composed of a slender short-stalked axis, its stipe being covered with minute closely imbricated scales, and of five or six whorls, each of three stamens, with broadly obovate acute and short-pointed connectives slightly thickened and keeled on the back, and bearing at the very base three or rarely four globose anther cells. The pistillate flower consists of three slightly spreading ovules abruptly enlarged and open at the apex, where a drop of clear stigmatic liquid is secreted when the ovule is ready for fecundation; below the ovules and alternate with them are three minute obtuse fleshy scales slightly united at the base and with the ovules, and subtended by five or six alternate whorls of ternate leaf-like scales. During the first year the fruit does not enlarge, resembling the flower-bud in its first winter; but, commencing to grow rapidly when the plant is in bloom in

[1] *Juniperus communis*, var. *Sibirica*, Rydberg, *Contrib. U. S. Nat. Herb.* iii. 533 (1896).

Juniperus communis, γ, Linnæus, *Spec.* 1040 (1753).

Juniperus communis, β, Lamarck, *Dict.* ii. 625 (1786). — Smith & Sowerby, *English Bot.* iii. t. 1086.

Juniperus Sibirica, Burgsdorf, *Anleit.* ii. 124 (1787). — K. Koch, *Dendr.* ii. pt. ii. 116. — Lauche, *Deutsche Dendr.* ed. 2, 57.

Juniperus Canadensis, Burgsdorf, *l. c.* (1787). — Loudon, *Arb. Brit.* iv. 2490, f. 2347. — Forbes, *Pinetum Woburn.* 204. — Carrière, *Traité Conif.* 20. — Knight, *Syn. Conif.* 11. — Gordon, *Pinetum*, 92. — Henkel & Hochstetter, *Syn. Nadelh.* 318. — (Nelson) Senilis, *Pinaceæ*, 144.

Juniperus communis, γ *montana*, Aiton, *Hort. Kew.* iii. 414 (1788). — Spach, *Ann. Sci. Nat.* sér. 2, xvi. 290 (*Révision des Juniperus*); *Hist. Vég.* xi. 309.

Juniperus nana, Willdenow, *Berl. Baumz.* 159 (1796); *Spec.* iv. pt. ii. 854; *Enum.* 1023. — Borkhausen, *Handb. Forstbot.* i. 766. — Schkuhr, *Handb.* iii. 496, t. 338. — Guimpel, Willdenow & Hayne, *Abbild. Deutsche Holz.* ii. 273, t. 207. — Hayne, *Dendr. Fl.* 205. — Smith, *English Fl.* iv. 252. — Ledebour, *Fl. Alt.* iv. 299; *Fl. Ross.* iii. 683. — Visiani, *Fl. Dalm.* i. 203. — Schouw, *Ann. Sci. Nat.* sér. 3, iii. 243 (*Conifères d'Italie*). — Reichenbach, *Icon. Fl. German.* xi. 5, t. 535. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 200. — Carrière, *l. c.* 18. — Knight, *l. c.* 11. — Koch, *Syn. Fl. German.* ed. 3, ii. 575. — Antoine, *Cupressineen-Gattungen*, 30, t. 42, f. O–U, 43–45. — Gordon, *l. c.* 97. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 23. — Henkel & Hochstetter, *l. c.* 318. — (Nelson) Senilis, *l. c.* 145. — Regel, *Russ. Dendr.* 13. — Willkomm, *Forst. Fl.* ed. 2, 267. — Hansen, *Jour. R. Hort. Soc.* xiv. 294 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 52.

Juniperus communis, β *alpina*, Wahlenberg, *Fl. Lapp.* 276 (1812). — Gaudin, *Fl. Helv.* vi. 301. — Spach, *Ann. Sci. Nat. l. c.*; *Hist. Vég. l. c.* 309. — Hoopes, *Evergreens*, 273. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 480. — Brewer & Watson, *Bot. Cal.* ii. 113. — Coulter, *Man. Rocky Mt. Bot.* 429. — Macoun, *Cat. Can. Pl.* 462; iv. 361. — Schübeler, *Virid. Norveg.* i. 357. — Watson & Coulter, *Gray's Man.* ed. 6, 494. — Otto Kuntze, *Rev. Gen. Pl.* ii. 798.

Juniperus communis nana, Baumgarten, *Enum. Stirp. Transs.* ii. 380 (1816). — Loudon, *Arb. Brit.* iv. 2489, f. 2344. — Hooker, *Fl. Bor.-Am.* ii. 165. — Forbes, *Pinetum Woburn.* 203. — Veitch, *Man. Conif.* 275. — Boissier, *Fl. Orient.* v. 707.

Juniperus communis, β *depressa*, Pursh, *Fl. Am. Sept.* ii. 646 (1814).

Juniperus alpina, S. F. Gray, *Nat. Arr. Brit. Pl.* ii. 226 (1821). — Grenier & Godron, *Fl. France*, iii. 157.

Juniperus communis vulgaris, Loudon, *l. c.* iv. 2489 (1838).

Juniperus nana, A *montana*, Endlicher, *Syn. Conif.* 14 (1847).

Juniperus nana, B *alpina*, Endlicher, *l. c.* (1847). — Regel, *l. c.* 13.

Juniperus pygmæa, K. Koch, *Linnæa*, xxii. 302 (1849).

[2] Henry, *Nov. Act. Acad. Cæs. Leop.* xix. 103, t. 14.

the following spring, its three upper scales become consolidated above the ovules, and at the beginning of the second winter it is globose, hard, light green, and about three quarters of its full size, the albumen of the seeds being soft and milky; it continues to develop during the following season, the albumen of the seeds gradually hardening; late in the summer it becomes dark blue or bluish black and covered with a glaucous bloom, and at maturity is subglobose or oblong, tipped with the remnants of the enlarged points of the ovules and raised on a short stem clothed by the unchanged scales which formed the outer covering of the female flower; the fruit is then about a quarter of an inch in diameter, with soft mealy resinous sweet flesh and from one to three seeds; when not eaten by birds it often remains on the branches one or two years after ripening.[1] The seeds are ovate, acute, irregularly angled or flattened by mutual pressure, deeply penetrated by the numerous prominent thin-walled irregularly shaped resin-glands, and free from the flesh only near the bright brown lustrous apex, about an eighth of an inch long, with a thick bony outer coat, a membranaceous light chestnut-brown inner coat, and a large two-lobed basal hilum to which the flesh is firmly attached.

Juniperus communis, which is the most widely distributed tree of the northern hemisphere, ranges in the New World across the continent and from southern Greenland[2] to the highlands of Pennsylvania on the Atlantic coast, and to northern Nebraska[3] and along the Rocky Mountains to Arizona,[4] New Mexico, and western Texas,[5] and on the Pacific coast from Alaska[6] to northern California.[7] In the Old World it inhabits the Kurile Islands[8] and Kamtschatka, and is widely spread over the remainder of northern, central, and eastern Asia, ranging southward to the northwestern Himalayas, where it sometimes ascends to 14,000 feet above the sea-level; it is common all through northern and central Europe, ascending mountain ranges to elevations of four or five thousand feet, and occurs, although less commonly, in the countries of the Mediterranean basin. In North America, although nowhere very abundant, it is generally distributed, growing, toward the southern limits of its range in the east, on gravelly sterile slopes or worn-out pastures, and in the west on high exposed mountain-slopes, and usually in shrubby forms only a few feet high, not assuming the habit of a small tree except in southern Illinois. Here on the bald and broken summits of conglomerate sandstone and limestone hills, in Union, Williamson, Johnson, Saline, Pope, Gallatin, and Hardin counties, it frequently attains a height of twenty-five feet and forms a trunk eight or ten inches in diameter, growing with *Juniperus Virginiana*, *Acer spicatum*, *Cratægus cordata*, *Quercus minor*, *Quercus rubra*, and *Vaccinium vacillans*. In northern Maine and on the alpine summits of the mountains of New England and New York, in northern Minnesota, on the Rocky Mountains, where it sometimes ascends to elevations of 10,000 feet, and on the mountains of British America and farther northward on both sides of the continent, it assumes its prostrate decumbent form on which the leaves are usually somewhat broader than on plants with erect stems. In northern and central Europe *Juniperus communis* inhabits plains and mountain-slopes, often ascending above the upper limit of the forest, and in some parts of northern Germany it is often gregarious, covering great areas with an open growth of shrubby plants which frequently, under the shade of trees, assume an arborescent habit and attain a height of thirty or forty feet;[9] in the countries bordering the Mediterranean and in western Asia it is usually found only on high mountain-slopes, sometimes ascending to elevations of nearly six thousand feet, although on the

[1] J. G. Jack, *Bot. Gazette*, xviii. 369, t. 33.

Mr. Jack's observations on the development of the flowers and fruit of *Juniperus communis* in the Arnold Arboretum first established the fact that the fruit of this species, in New England at least, does not mature until the third year.

[2] Hooker f. *Trans. Linn. Soc.* xxiii. 302 (*Arctic Plants*). — Rink, *Danish Greenland*, 410.

[3] Bessey, *Rep. Nebraska State Board Agric.* 1894, 101.

[4] *Juniperus communis* occurs on the high San Francisco peaks.

[5] Coulter, *Contrib. U. S. Nat. Herb.* ii. 555 (*Man. Pl. W. Texas*).

[6] Bongard, *Mém. Phys. Nat. Pt.* 2, *Acad. Sci. St. Pétersbourg*, ii. 163 (*Veg. Sitcha*) (*Juniperus nana*). — Rothrock, *Smithsonian Rep.* 1867, 455 (*Fl. Alaska*) (*Juniperus nana*). — F. Kurtz, *Bot. Jahrb.* xix. 425 (*Fl. Chilcatgebietes*).

[7] Engelmann, *Brewer & Watson Bot. Cal.* ii. 113. — Lemmon, *Rep. California State Board Forestry*, iii. 184 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 78.

[8] Miyabe, *Mem. Bost. Soc. Nat. Hist.* iv. 260 (*Fl. Kurile Islands*).

[9] Willkomm, *Forst. Fl.* ed. 2, 261, f. 34.

Italian Riviera occasionally descending to the sea-level. On the northwestern Himalayas and in Thibet it inhabits high dry steep slopes, often reaching elevations of twelve or fourteen thousand feet, and forming, far above the upper limits of the forest, great thickets a few feet high, growing gregariously or mixed with *Juniperus recurva*.[1]

The wood of *Juniperus communis* grown in the United States has not been examined scientifically. It is hard, close-grained, very durable in contact with the soil, and light brown, with pale sapwood and a fine surface susceptible of receiving a beautiful polish. In Europe it is sometimes used for vine-stakes, and is made into canes and other small articles.[2] In India it is burned, like the twigs, as incense, and on the high Himalayan passes is used as fuel.[3] The sweet aromatic fruit is gathered in northern Europe in large quantities for the sake of the peculiar flavor and diuretic properties which it imparts to gin; and, although no longer believed to possess the peculiar virtues ascribed to it by herbalists two centuries ago,[4] it is still occasionally employed medicinally in the United States[5] and Europe, and in native Indian practice.

Juniperus communis has long been cultivated in the gardens of Europe; in the seventeenth century it was a favorite subject for topiary decoration, and it may still be seen in English and Dutch gardens cut into bowls, globes, animals, and other fantastic shapes.[6] Of the many forms which are recognized in gardens, the most distinct is the Swedish Juniper,[7] which, with erect branches making a narrow compact pyramidal head, occasionally attains a height of eighteen or twenty feet; other forms, distinguished by a columnar or a dwarfed and compact habit, by pendulous branches[8] or by yellow foliage, are also frequently cultivated.[9]

[1] Madden, *Jour. Agric. and Hort. Soc. Ind.* vii. pt. ii. 153 (*Himalayan Coniferæ*). — Brandis, *Forest Fl. Brit. Ind.* 535.

[2] Loudon, *Arb. Brit.* iv. 2489.

[3] Gamble, *Man. Indian Timbers*, 411. — Balfour, *Cyclopædia of India*, ed. 3, ii. 454.

[4] Parkinson, *Theatr.* 1030.

[5] Johnson, *Man. Med. Bot. N. Am.* 261, f. 156.

[6] Loudon, *l. c.* 2493.

[7] *Juniperus communis Suecica*, Loudon, *Arb. Brit.* iv. 2489, f. 2343 (1838). — Knight, *Syn. Conif.* 11. — Carrière, *Traité Conif.* 22. — Gordon, *Pinetum*, 24. — Henkel & Hochstetter, *Syn. Nadelh.* 321. — (Nelson) Senilis, *Pinaceæ*, 145. — Hoopes, *Evergreens*, 274. — Veitch, *Man. Conif.* 276. — Beissner, *Handb. Nadelh.* 136.

Juniperus Suecica, Miller, *Dict.* ed. 8, No. 2 (1768). — Forbes, *Pinetum Woburn.* 203.

? Juniperus communis, β *Hispanica*, Endlicher, *Syn. Conif.* 15 (1847).

Juniperus communis, β *fastigiata*, Parlatore, *De Candolle Prodr.* xvi. pt. ii. 479 (in part) (1868). — Masters, *Jour. R. Hort. Soc.* xiv. 212 (in part).

Juniperus communis pyramidalis, Hansen, *Jour. R. Hort. Soc.* xiv. 293 (*Pinetum Danicum*).

The Swedish Juniper, which is said to grow naturally in southern Scandinavia, and to reproduce its peculiar habit from seed, has long been a favorite garden plant.

[8] *Juniperus communis oblonga-pendula*, Carrière, *Man. Pl.* iv. 310. — Beissner, *l. c.* 137.

Juniperus oblonga pendula, Loudon, *Arb. Brit.* 2490, f. 2345 (1838). — Carrière, *Traité Conif.* ed. 2, 20.

Juniperus communis, β *reflexa*, Carrière, *l. c.* 22 (1855). — Parlatore, *l. c.*

Juniperus communis, B *reflexa*, β *pendula*, Carrière, *l. c.* 23 (1855).

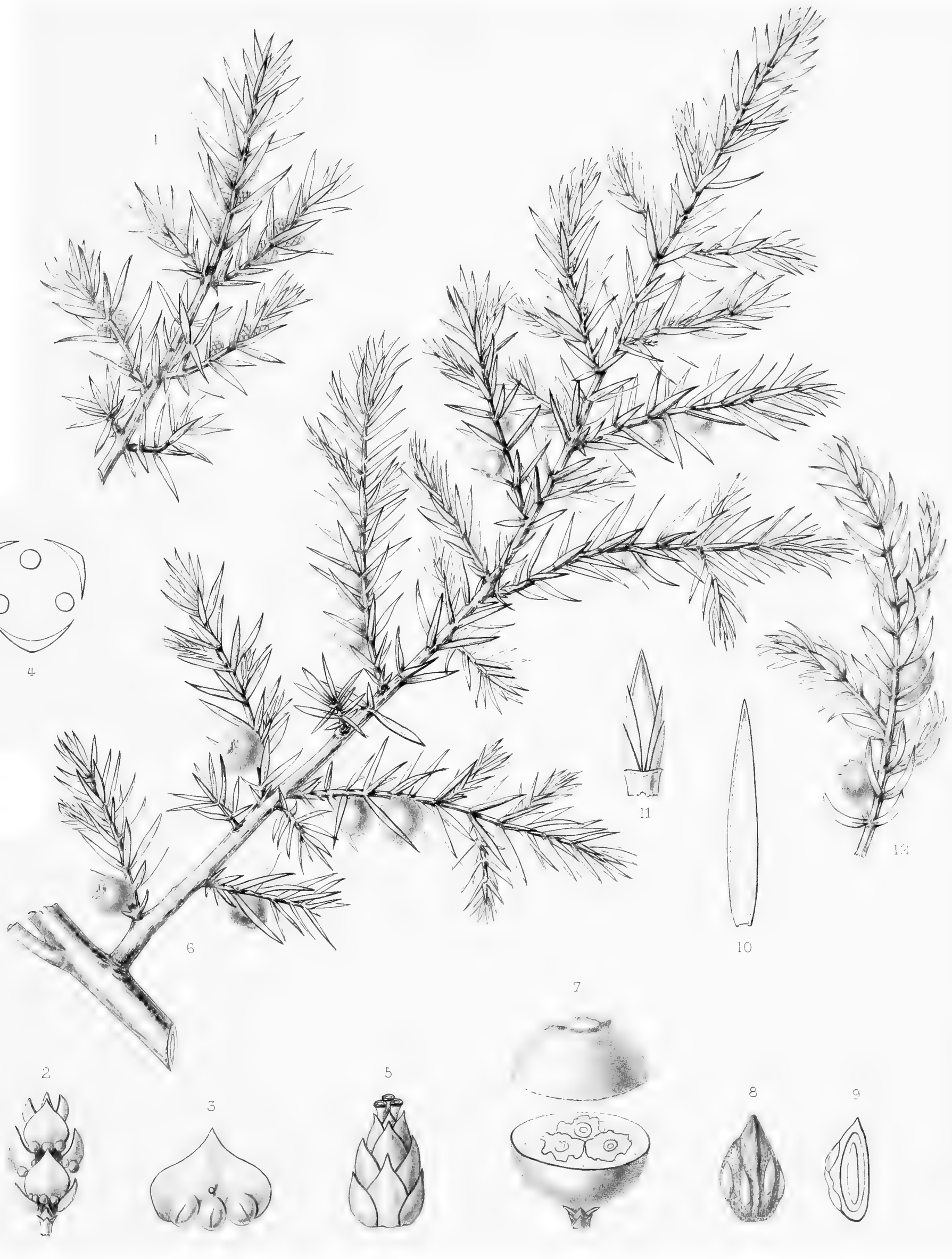
Juniperus oblonga, Gordon, *l. c.* 98 (not Marschall von Bieberstein). — Henkel & Hochstetter, *l. c.* 322 (excl. syn.). — Hoopes, *l. c.* 277.

[9] For other garden forms of *Juniperus communis*, see Veitch, *l. c.* 275. — Beissner, *l. c.* 136.

EXPLANATION OF THE PLATE.

PLATE DXVI. JUNIPERUS COMMUNIS.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. Diagram of a pistillate flower.
5. A pistillate flower, enlarged.
6. A fruiting branch, natural size.
7. A fruit divided transversely, enlarged.
8. A seed, enlarged.
9. Vertical section of a seed, enlarged.
10. A leaf, upper surface, enlarged.
11. A bud, enlarged.
12. A fruiting branch of the var. *Sibirica*, natural size.



C.E. Faxon del. Himely sc.

JUNIPERUS COMMUNIS, L.

A. Riocreux direx.t. Imp. J. Taneur, Paris.

JUNIPERUS CALIFORNICA.

Juniper.

FRUIT usually oblong; seeds 1 or 2. Leaves ternate, rounded at the apex, conspicuously glandular. Branchlets stout.

Juniperus Californica, Carrière, *Rev. Hort.* 1854, 352, f. 21; *Traité Conif.* 58, ed. 2, 41. — Gordon, *Pinetum*, 121. — Engelmann, *Trans. St. Louis Acad.* iii. 588 (excl. syn. *Juniperus Cerrosiana*); *Rothrock Wheeler's Rep.* vi. 375; *Brewer & Watson Bot. Cal.* ii. 113. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 180 (excl. syn. *Juniperus Cerrosiana*). — Beissner, *Handb. Nadelh.* 129. — Lemmon, *Rep. California State Board Forestry*, iii. 183, t. 28, f. 1 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 79.

Juniperus pyriformis, Lindley, *Gard. Chron.* 1855, 420.

Sabina osteosperma, Antoine, *Cupressineen-Gattungen*, 51 (1857).

Sabina Californica, Antoine, *Cupressineen-Gattungen*, 52, t. 71, 72 (1857).

Juniperus tetragona, var. **osteosperma**, Torrey, *Pacific R. R. Rep.* iv. pt. v. 141 (1858); *Bot. Mex. Bound. Surv.* 210; *Ives' Rep.* 28.

Juniperus tetragona, Cooper, *Smithsonian Rep.* 1858, 263 (not Schlechtendal) (1859).

Juniperus occidentalis, Gordon, *Pinetum*, Suppl. 38 (in part) (1864); *Pinetum*, ed. 2, 162 (in part). — Henkel & Hochstetter, *Syn. Nadelh.* 345 (in part). — Hoopes, *Evergreens*, 299 (in part). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 489 (in part). — Veitch, *Man. Conif.* 286 (in part).

A conical tree, occasionally forty feet in height, with a straight large-lobed unsymmetrical trunk from one to two feet in diameter; or more often shrubby, with numerous stout irregular often contorted erect branches which form a broad open head. The bark of the trunk is thin and divided into long loose shred-like scales which are ashy gray on the outer surface and persistent for many years, and in separating display the reddish brown inner bark. The branchlets are stout, light yellow-green at first, rather bright red-brown in their third or fourth season, and at the end of four or five years, after the leaves have fallen, covered with thin light gray-brown scaly bark. The leaves are usually in threes, closely appressed, thickened, slightly keeled and conspicuously glandular-pitted on the back, rounded at the apex, distinctly cartilaginously fringed on the margins, light yellow-green, and about an eighth of an inch long, and die and turn brown on the branch at the end of two or three years; those on vigorous shoots and young plants are linear-lanceolate, rigid, sharp-pointed, from one quarter to one third of an inch long, and whitish on the upper surface. The flowers open from January to March. The staminate flower is from one eighth to nearly one quarter of an inch in length, with from eighteen to twenty-four stamens; these are usually disposed in threes, with rhomboidal short-pointed connectives or anther-scales. The scales of the pistillate flower are ovate, acute, spreading, and usually six in number, and are obliterated or minute on the fruit. This ripens in the early autumn of the second season and is globose or oblong, from one third to one quarter of an inch long, reddish brown, with a membranaceous loose epidermis covered by a thick glaucous bloom, thin fibrous dry sweet flesh, and one or two large seeds. The seeds are ovate, acute, and short-pointed, irregularly lobed and angled, flattened by mutual pressure on the inner surface when more than one is produced, light chestnut-brown and lustrous toward the apex, marked below by a large bilobed whitish hilum, and thick-walled, the outer layer of the wall being hard and bony and the inner thin, white, and cartilaginous; the cotyledons are from four to six in number.

Juniperus Californica inhabits dry mountain-slopes and plains, and is distributed from the valley of the lower Sacramento River southward through the California coast ranges to Lower California; spreading inland along the coast mountains to their union with the Sierra Nevada, it ranges northward along the western slopes of these at least as far as the neighborhood of Kernville, descending as low

as two thousand six hundred feet above the sea-level and ascending to the summit of Walker's Pass. It occurs on the desert slopes of the Tehachapi Mountains, and is abundant on the northern foothills of the San Bernardino Mountains, where it is scattered through the upper part of the forest of *Yucca arborescens* at elevations of three or four thousand feet.[1] It is common on the southern foothills of these mountains and on the seaward slopes of the San Jacinto and Cuyamaca ranges.

The wood of *Juniperus Californica* is light, soft, close-grained, and durable in contact with the soil; it contains numerous obscure medullary rays and dark inconspicuous bands of small summer-cells, and is light brown slightly tinged with red, with thin nearly white sapwood. The specific gravity of the absolutely dry wood is 0.6282, a cubic foot weighing 39.15 pounds. In southern California it is used for fencing and fuel.

The fruit is gathered in large quantities by Indians, who eat it fresh, or grind it into flour which they bake into nutritious fattening cakes.[2]

Long confounded with *Juniperus occidentalis* by European botanists, probably *Juniperus Californica* is not now cultivated in gardens.[3]

[1] Merriam, *North American Fauna*, No. 7, 340 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 224 (*Bot. Death Valley Exped.*). — S. B. Parish, *Zoë*, iv. 352.

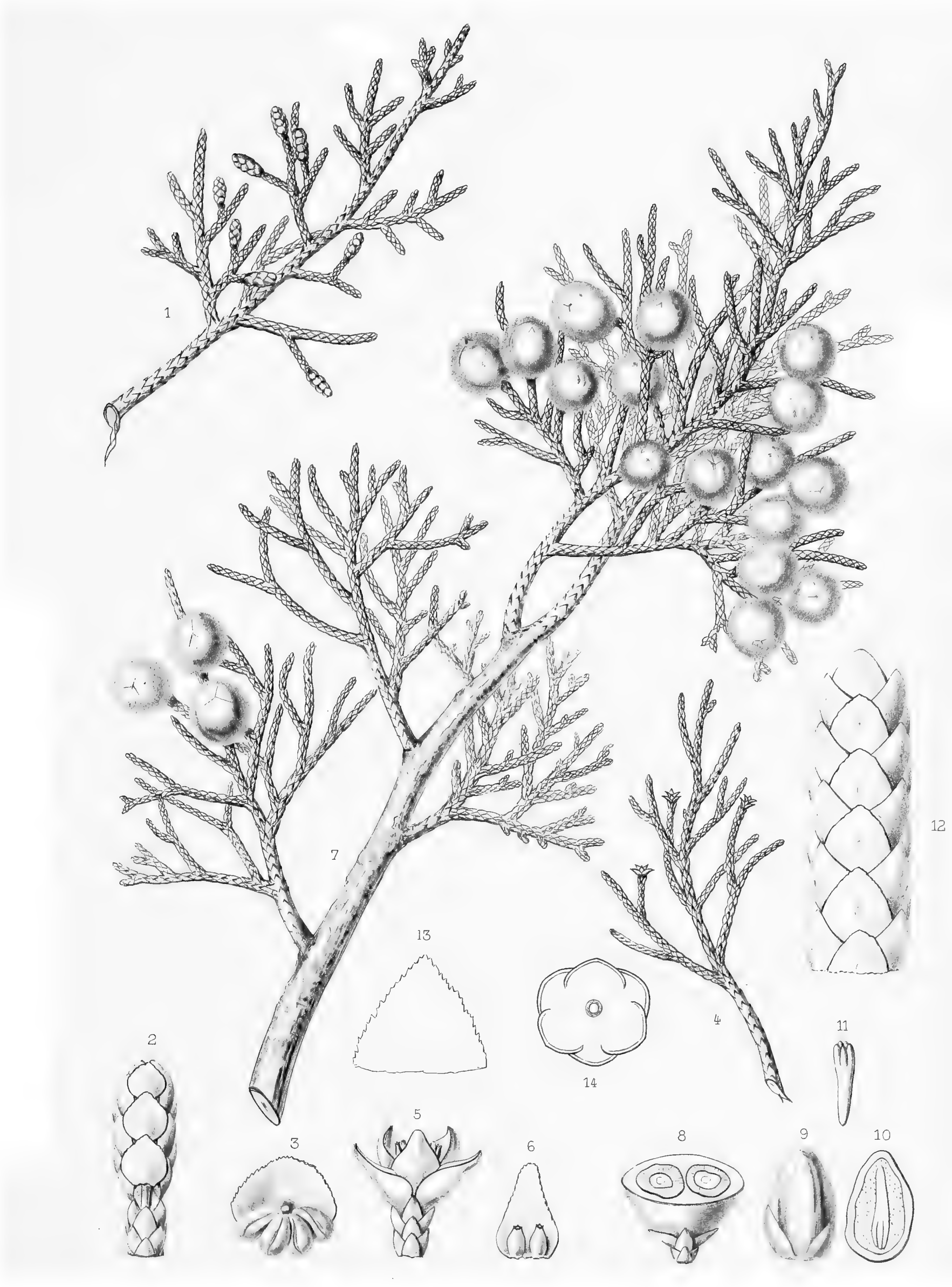
[2] Palmer, *Am. Nat.* xii. 594.

[3] By Carrière, who first described this tree in 1854, it is said to have been discovered by a Monsieur Boursier de la Rivière. Lindley, in his description of *Juniperus pyriformis* (*Gard. Chron.* 1854, 420), which from the characters and the locality must be referred to *Juniperus Californica*, speaks of its introduction by William Lobb into the Veitchs' nursery at Exeter, England, probably in 1852.

EXPLANATION OF THE PLATE.

PLATE DXVII. JUNIPERUS CALIFORNICA.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A flowering branch of the pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. A scale of the pistillate flower with its ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. Cross section of a fruit, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. End of a branchlet, enlarged.
13. End of a leaf, enlarged.
14. Cross section of a branchlet, enlarged.



C.E. Faxon del. Himely sc.

JUNIPERUS CALIFORNICA, Carr.

A. Riocreux direx.t Imp. J. Taneur, Paris.

JUNIPERUS UTAHENSIS.

Juniper.

FRUIT usually globose; seeds solitary or rarely in pairs. Leaves ternate or binate, acute or acuminate, eglandular. Branchlets slender.

Juniperus Utahensis, Lemmon, *Rep. California State Board Forestry*, iii. 183, t. 28, f. 2 (*Cone-Bearers of California*) (1890).

Juniperus Californica, var. **Utahensis**, Engelmann, *Trans. St. Louis Acad.* iii. 588 (1877); *Rothrock Wheeler's Rep.* vi. 264; *Brewer & Watson Bot. Cal.* ii. 113. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 180.

Juniperus occidentalis, Watson, *King's Rep.* v. 336 (in part) (not Hooker) (1871); *Pl. Wheeler*, 18.

Juniperus occidentalis, var. **Utahensis**, Veitch, *Man. Conif.* 289 (1881).

A bushy tree, rarely exceeding twenty feet in height, with a short usually eccentric trunk sometimes two feet in diameter, and generally divided near the ground by irregular deep fissures into broad rounded ridges, and with many erect contorted branches which form a broad open head; or more often with numerous stems springing from the ground and frequently not more than eight or ten feet in height. The bark of the trunk is about a quarter of an inch in thickness, ashy gray or sometimes nearly white, and broken into long thin persistent scales. The branchlets are slender and light yellow-green, and after the falling of the leaves are covered with thin light red-brown scaly bark. The leaves are opposite or occasionally in threes, closely appressed, rounded and eglandular on the back, acute or often acuminate, slightly toothed on the margins, light yellow-green, and rather less than an eighth of an inch long, and, dying and turning brown on the branches, are persistent for many years; on young shoots they are often elongated and long-pointed, passing gradually into the acerose leaves of more vigorous shoots and of seedling plants. The staminate flower is composed of from eighteen to twenty-four opposite or ternate stamens, with rhomboidal connectives or anther-scales. The scales of the pistillate flower are acute, spreading, and often in pairs. The fruit, which ripens during the autumn of the second season, is subglobose or oblong, marked by the more or less prominent tips of the flower-scales, reddish brown, with a thick firm epidermis closely investing the thin dry fibrous sweet flesh, and covered with a glaucous bloom which often gives it, especially during its first season, a bluish appearance; it is from one eighth to one quarter of an inch long, and contains one or rarely two seeds. The seed is ovate, acute, conspicuously and acutely angled, marked nearly to the apex by the two-lobed pale hilum, and from one sixteenth to one eighth of an inch long, with a hard bony outer wall, a membranaceous pale brown inner coat; the embryo has from four to six cotyledons.

Juniperus Utahensis is found only in the desert region between the Rocky Mountains and the Sierra Nevada, where it is the most abundant and generally distributed tree, ranging from the western foothills of the Wasatch Mountains in eastern Utah to southeastern California, northern Arizona, and western Colorado.[1] In central Nevada it is the only tree which descends into the valleys, where it is often abundant and forms open stunted forests at elevations of about five thousand feet above the sea-level; on the arid slopes of the mountains of this region it is still more common and of larger size, forming with the Nut Pine the forest growth at elevations up to eight thousand feet.[2] It is common on the mountain ranges of southern Nevada, clothing with the Nut Pine many of their summits, and occurs, although less abundantly, on those of southeastern California; it covers with a continuous nearly pure forest twenty miles wide the Juniper Mountains, a rolling plateau six or seven

[1] *Juniperus Utahensis* is the common Juniper on the high plateaus of western Colorado, and the valley of Grand River.

[2] Sargent, *Am. Jour. Sci.* ser. 3, xvii. 418 (*The Forests of Central Nevada*).

thousand feet above the sea which extends from Nevada into southwestern Utah;[1] abundant also on many of the other mountain ranges of southern Utah, it spreads southward over northeastern Arizona to the plateau immediately south of the Grand Cañon of the Colorado,[2] where it grows with *Juniperus monosperma*, *Pinus ponderosa*, and the Nut Pine.

The wood of *Juniperus Utahensis* is light, soft, close-grained, compact, and very durable in contact with the soil. It is light brown, and slightly fragrant, with thick nearly white sapwood. The specific gravity of the absolutely dry wood is 0.5522, a cubic foot weighing 34.41 pounds.[3] The cheapest and most accessible fuel and the best fencing material of the desert region which it inhabits, this tree is rapidly disappearing to supply the wants of farmers and miners.

The fruit is gathered by Indians, who eat it fresh or bake it into cakes.[4]

Usually considered a variety of *Juniperus Californica*, *Juniperus Utahensis* appears to be specifically distinct in its more slender branches and usually glandless opposite leaves, in its smaller and generally one-seeded fruit, and in its range, the two forms being separated by the Mohave Desert and never mingling.

[1] Merriam, *North American Fauna*, No. 7, 120 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 224 (*Bot. Death Valley Exped.*).

[2] Merriam, *North American Fauna*, No. 3, 120.

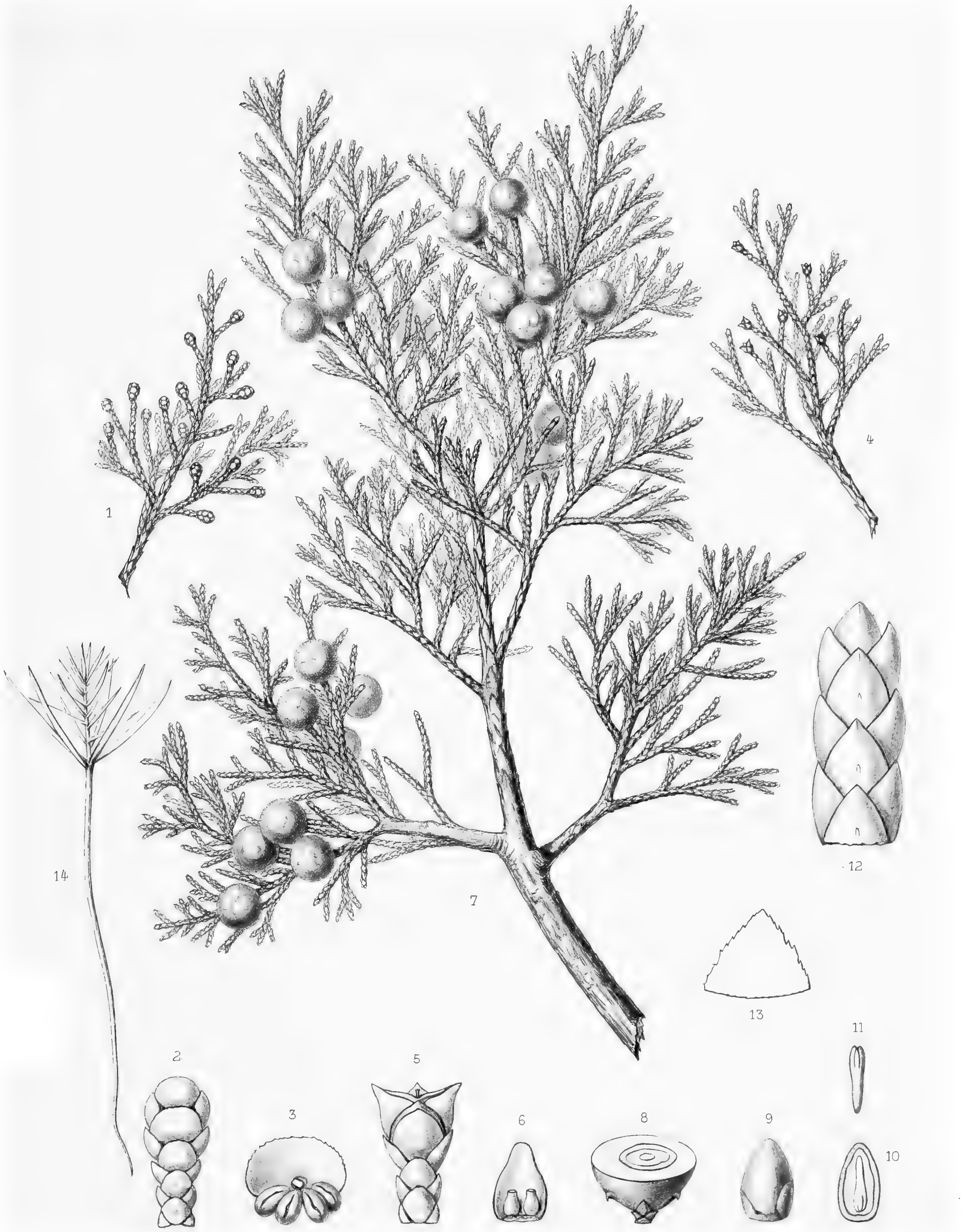
[3] *Juniperus Utahensis* grows very slowly. A specimen of the wood which I collected on the Monitor Range of mountains in central Nevada, and which is four and a half inches in diameter, shows one hundred and five layers of annual growth, or an annual average growth of a little less than one fiftieth of an inch (see *Am. Jour. Sci.* ser. 3, xvii. 418 [*The Forests of Central Nevada*]); while the log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, collected by Mr. T. S. Brandegee at Fish Creek, near Eureka, Nevada, is eleven and three quarters inches in diameter inside the bark, and two hundred and fifteen years old.

[4] Palmer, *Am. Nat.* xii. 594.

EXPLANATION OF THE PLATE.

Plate DXVIII. Juniperus Utahensis.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A flowering branch of the pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. A scale of the pistillate flower with its ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. Cross section of a fruit, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. End of a branch, enlarged.
13. Tip of a leaf, enlarged.
14. A seedling, natural size.



C.E. Faxon del. Rapine sc.

JUNIPERUS UTAHENSIS, Lemm.

A. Riocreux direx.t Imp. J. Taneur, Paris.

JUNIPERUS FLACCIDA.

Juniper.

FRUIT oblong or globose; seeds 4 to 12. Leaves binate, glandular, often slightly spreading at the acute or acuminate apex. Branchlets slender.

Juniperus flaccida, Schlechtendal, *Linnæa*, xii. 495 (1838). — Bentham, *Pl. Hartweg.* 57. — Endlicher, *Syn. Conif.* 29. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 202. — Knight, *Syn. Conif.* 12. — Carrière, *Traité Conif.* 48. — Gordon, *Pinetum*, 103. — Henkel & Hochstetter, *Syn. Nadelh.* 341. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 492. — K. Koch, *Dendr.* ii. pt. ii. 143. — Engelmann, *Trans. St. Louis Acad.* iii. 589. — Hemsley, *Bot. Biol. Am. Cent.* iii. 184. — Havard, *Proc. U. S. Nat. Mus.* viii. 504. — Beissner, *Handb. Nadelh.* 115. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 556 (*Man. Pl. W. Texas*).

Juniperus fœtida, *θ* **flaccida**, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 300 (*Révision des Juniperus*) (1841).

Sabina flaccida, Antoine, *Cupressineen-Gattungen*, 37, t. 49, 50, f. M–T (1857).

Juniperus gracilis, K. Koch, *Berl. Allg. Gartenzeit.* 1858, 341 (not Endlicher).

A tree, occasionally thirty feet in height, with graceful spreading branches and long slender drooping branchlets covered, after the leaves have fallen, with thin bright cinnamon-brown bark separating into thin loose papery scales, or more often shrubby. The leaves are opposite, long-pointed, and sometimes slightly spreading at the apex, rounded and conspicuously glandular on the back, slightly denticulate, light yellow-green, and rather more than an eighth of an inch long, and turn cinnamon-red as they die on the branch before falling; on vigorous young shoots they are ovate-lanceolate, and sometimes half an inch in length, and terminate in elongated rigid callous tips. The staminate flowers are slender, quadrangular, and composed of from sixteen to twenty stamens, with ovate long-pointed connectives or anther-scales prominently keeled on the back. The fruit is globose or oblong, irregularly tuberculate, dull red-brown, more or less covered with a glaucous bloom, marked by the numerous reflexed tips of the flower-scales, and from one half to three quarters of an inch long, with a close firm epidermis and dry mealy flesh in which are imbedded in several tiers from four to twelve often abortive distorted seeds, with an embryo with two cotyledons, and about an eighth of an inch in length.

In the United States *Juniperus flaccida* is known to grow only on the slopes of the Chisos Mountains in southwestern Texas, where it was found in September, 1883, by Dr. Valéry Havard.[1] It is common in northeastern Mexico, growing at elevations of from six to eight thousand feet on the hills to the east of the Mexican table-lands, ranging from the state of Coahuila to that of Oaxaca, and extending eastward to about the distance of one hundred miles from the coast.

The wood of *Juniperus flaccida* has not been examined.

According to Carrière,[2] *Juniperus flaccida* was introduced into Europe in 1838; it is occasionally cultivated in the gardens of southern France, where it ripens its fruit, and in Algeria.[3]

[1] See i. 81.

[2] *Traité Conif.* 48.

[3] Carrière, *l. c.* ed. 2, 48.

EXPLANATION OF THE PLATE.

PLATE DXIX. JUNIPERUS FLACCIDA.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A flowering branch of the pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. A fruiting branch, natural size.
7. A fruit divided transversely, enlarged.
8. A seed, enlarged.
9. Vertical section of a seed, enlarged.
10. An embryo, enlarged.
11. End of a branchlet, enlarged.
12. End of a leaf, enlarged.

C.E. Faxon del. Migneaux sc.

JUNIPERUS FLACCIDA, Schlecht.

A. Riocreux, direx.t Imp. J Taneur, Paris

JUNIPERUS PACHYPHLÆA.

Juniper. Checkered-barked Juniper.

FRUIT globose; seeds usually 4. Leaves opposite, closely appressed, rounded and apiculate at the apex, glandular. Branchlets slender. Bark thick, broken into small oblong plates.

Juniperus pachyphlæa, Torrey, *Pacific R. R. Rep.* iv. pt. v. 142 (1858); *Bot. Mex. Bound. Surv.* 210; *Ives' Rep.* 28. — Henkel & Hochstetter, *Syn Nadelh.* 347. — Carrière, *Traité Conif.* ed. 2, 56. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 490. — Gordon, *Pinetum*, ed. 2, 164. — Engelmann, *Trans. St. Louis Acad.* iii. 589; *Rothrock Wheeler's Rep.* vi. 264. — Rusby, *Bull. Torrey Bot. Club*, ix. 79. — Hemsley, *Bot. Biol. Am. Cent.* iii. 184. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 181. — Beissner, *Handb. Nadelh.* 130. — Lemmon, *Rep. California State Board Forestry*, iii. 182 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 81.

Sabina pachyphlæa, Antoine, *Cupressineen-Gattungen*, 39 (1857).

Sabina plochyderma, Antoine, *Cupressineen-Gattungen*, 40, t. 52 (1857).

Juniperus plochyderma, Parlatore, *De Candolle Prodr.* xvi. pt. ii. 492 (1868).

A tree, in the United States often fifty or sixty feet in height, with a short trunk from three to five feet in diameter, and long stout spreading branches which form a broad-based, pyramidal, open, or ultimately a compact round-topped head. The bark of the trunk is from three quarters of an inch to almost four inches in thickness, and is dark brown tinged with red, deeply fissured and divided into nearly square plates an inch or two in length, which separate on the surface into small thin closely appressed scales. The branchlets are slender, and after the disappearance of the leaves are covered with thin light red-brown bark, usually smooth and close, but occasionally broken into large thin scales. The leaves are in pairs, appressed, ovate, rounded and apiculate at the apex, slightly denticulate, thickened, obscurely keeled and conspicuously glandular on the back, bluish green, and rather less than an eighth of an inch long; those on vigorous shoots and young branches are linear-lanceolate, rigid, tipped with slender elongated cartilaginous points, and, like the young branchlets, pale blue-green. The flowers open in February and March. The staminate flowers are stout, about an eighth of an inch in length, with ten or twelve stamens, their connectives or anther-scales being broadly ovate, obscurely keeled on the back, and short-pointed. The scales of the pistillate flower are ovate, acuminate, and spreading. The fruit, which ripens in the autumn of the second season, is globose or oblong, often irregularly tuberculate, about half an inch long, usually marked with the short tips of the flower-scales, occasionally open and exposing the seeds at the apex, dark red-brown, and more or less covered with a glaucous bloom, especially during the first season, when it is often bluish in color; it is inclosed in a thin firm epidermis, closely investing the thick dry mealy flesh, which is filled during the first season with small resin glands, and usually contains four seeds; these are acute, conspicuously ridged and gibbous on the back, light brown at the apex, marked below by large pale bilobed hilums, and thick-walled, with a pale inner coat, and an embryo with two cotyledons.

Juniperus pachyphlæa inhabits dry arid mountain-slopes, where it grows with Pines and Evergreen Oaks, usually at elevations of from four to six thousand feet above the level of the sea, and is distributed from the Eagle and Limpia Mountains in southwestern Texas westward along the desert ranges of New Mexico and Arizona south of the Colorado plateau, but extending northward to the lower slopes of many of the high mountains of northern Arizona.[1] In Mexico it ranges southward along the Sierra Madre to the state of Jalisco and over the mountains of northern Sonora, often growing

[1] Merriam, *North American Fauna*, No. 3, 120. — Coville, *Contrib. U. S. Nat. Herb.* iv. 225 (*Bot. Death Valley Exped.*).

on the Mexican highlands to a height of fifty feet, and forming a trunk frequently three or four feet in diameter. Flourishing with the greatest luxuriance in rich well-watered cañons, it thrives also on high dry elevated slopes and rocky ledges, ranging through nearly five thousand feet of elevation on the cordilleras of Chihuahua.[1]

The wood of *Juniperus pachyphlœa* is light, soft, not strong, brittle, and close-grained; it contains numerous obscure medullary rays and inconspicuous thin bands of small summer-cells, and is clear light red often streaked with yellow, with thin nearly white sapwood. The specific gravity of the absolutely dry wood is 0.5829, a cubic foot weighing 36.32 pounds.[2]

The fruit is gathered and eaten by Indians.[3]

Juniperus pachyphlœa was discovered in August, 1851, on the Zuñi Mountains of eastern New Mexico by Dr. S. W. Woodhouse,[4] the surgeon and naturalist of Captain Sitgreaves' expedition down the Zuñi and Colorado Rivers.[5]

The open shapely head, the cheerful color, and massive trunk of *Juniperus pachyphlœa* covered with thick checkered bark unlike that of any other Juniper, make it the most beautiful of the species of western America, and a handsome and always an interesting object in the elevated mountain cañons which are its home.

Juniperus pachyphlœa is occasionally cultivated in the gardens of Europe.[6]

[1] Pringle, *Garden and Forest*, i. 441.

[2] The log specimen of *Juniperus pachyphlœa* in the Jesup Collection of North American Woods in the American Museum of Natural History in New York is seventeen and three quarters inches in diameter inside the bark, and shows two hundred and forty-eight layers of annual growth, thirty-four of which are of sapwood.

[3] Palmer, *Am. Nat.* xii. 593.

[4] See viii. 88.

[5] The first mention of *Juniperus pachyphlœa* appears in Dr. Woodhouse's report of the natural history of the country passed over by Sitgreaves' expedition (*Sitgreaves' Rep.* 35). On page 173 of the same report Torrey describes the tree briefly, without giving it a name, and plate 16 of the volume is devoted to a portrait of one of the trees which, on the plate, is called *Juniperus plochyderma.*

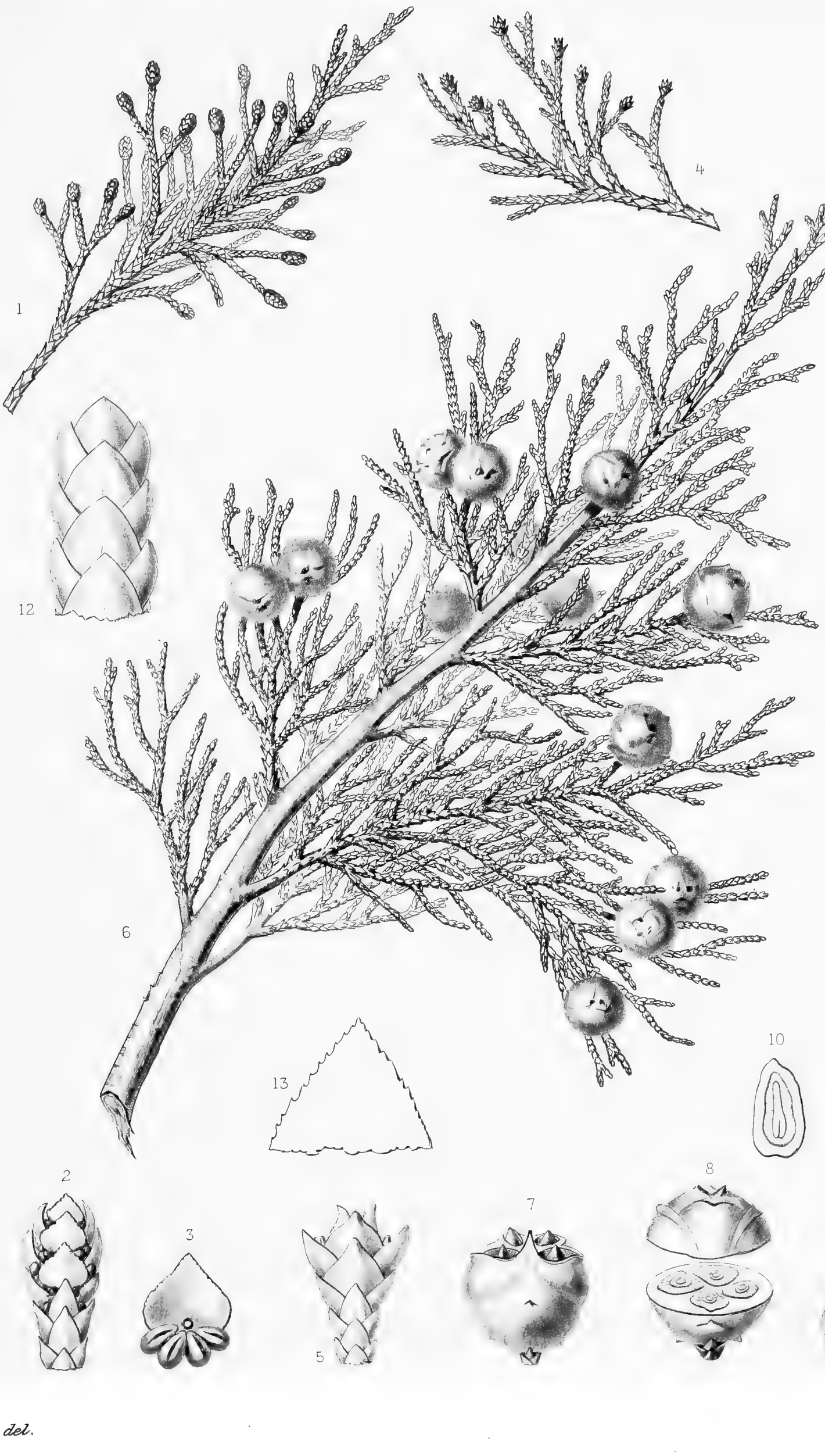
[6] Veitch, *Man. Conif.* 289.

In England *Juniperus pachyphlœa* appears to be sometimes cultivated as *Juniperus pendula.* (See Masters, *Jour. R. Hort. Soc.* xiv. 214.)

EXPLANATION OF THE PLATE.

PLATE DXX. JUNIPERUS PACHYPHLÆA.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A flowering branch of the pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. A fruiting branch, natural size.
7. A fruit with protruding seeds, enlarged.
8. A fruit divided transversely, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. End of a branchlet, enlarged.
13. End of a leaf, enlarged.



C.E. Faxon del. *Himely sc.*

JUNIPERUS PACHYPHLÆA, Torr.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

JUNIPERUS OCCIDENTALIS.

Juniper.

FRUIT large, subglobose or oblong, the flesh filled with large resin glands; seeds 2 or 3. Leaves ternate, acute or acuminate, conspicuously glandular. Branchlets stout.

Juniperus occidentalis, Hooker, *Fl. Bor.-Am.* ii. 166 (1839). — Endlicher, *Syn. Conif.* 26. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 202. — Carrière, *Traité Conif.* 42 (in part); ed. 2, 40 (in part). — Torrey, *Pacific R. R. Rep.* iv. pt. v. 142. — Gordon, *Pinetum*, 117 (excl. syn.); Suppl. 38 (excl. syn.); ed. 2, 162 (excl. syn.). — Henkel & Hochstetter, *Syn. Nadelh.* 345 (in part). — (Nelson) Senilis, *Pinaceæ*, 142. — Hoopes, *Evergreens*, 299 (excl. syn. *Juniperus Californica*). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 489 (in part). — Engelmann, *Brewer & Watson Bot. Cal.* ii. 113. — Veitch, *Man. Conif.* 289. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 181. — Coulter, *Man. Rocky Mt. Bot.* 429. — Lemmon, *Rep. California State Board Forestry*, iii. 183, t. 28, f. 1 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 80. — Beissner, *Handb. Nadelh.* 128. — Masters, *Jour. R. Hort. Soc.* xiv. 213 (excl. syn. *Juniperus pyriformis*). — Hansen, *Jour. R. Hort. Soc.* xiv. 294 (*Pinetum Danicum*). — Merriam, *North American Fauna*, No. 7, 343 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 225 (*Bot. Death Valley Exped.*).

Juniperus excelsa, Pursh, *Fl. Am. Sept.* ii. 647 (not Marschall von Bieberstein) (1814). — Nuttall, *Gen.* ii. 245.

Juniperus Andina, Nuttall, *Sylva*, iii. 95, t. 110 (1849). — Carrière, *Traité Conif.* ed. 2, 55.

Sabina occidentalis, Antoine, *Cupressineen-Gattungen*, 64, t. 84–86 (1857).

Juniperus Hermanni, K. Koch, *Dendr.* ii. pt. ii. 141 (excl. syn. *Juniperus Californica*) (not Sprengel) (1863).

Juniperus occidentalis, α **pleiosperma**, Engelmann, *Trans. St. Louis Acad.* iii. 590 (1877).

A tree, occasionally sixty feet in height, with a tall straight trunk two or three feet in diameter, but more often not exceeding twenty feet in height, with a short trunk sometimes ten feet in diameter, and enormous branches spreading nearly at right angles and forming a broad low head; or usually smaller, and frequently, when growing on dry rocky slopes and toward the northern limits of its range, shrubby with many short erect or semiprostrate stems. The bark of the trunk is about half an inch in thickness, bright cinnamon-red, and divided by broad shallow fissures into wide flat irregularly connected ridges separating on the surface into thin lustrous scales. The branchlets are stout, and after the leaves fall are covered with thin bright red-brown bark which breaks into loose papery scales. The leaves are disposed in threes and are closely appressed, ovate, acute or acuminate, denticulately fringed on the margins, rounded and conspicuously glandular on the back, gray-green, and about an eighth of an inch in length. The staminate flowers are stout, obtuse, and about an eighth of an inch long, with from twelve to eighteen broadly ovate rounded acute or apiculate connectives or anther-scales thin and scarious or slightly ciliate on the margins. The scales of the staminate flower are ovate, acute, spreading, and mostly obliterated from the fruit; this is subglobose or oblong, and from a quarter to a third of an inch in length, with a thick firm blue-black epidermis coated with a glaucous bloom, thin dry flesh filled with large resin glands, and two or three seeds. The seeds are ovate, acute, rounded and deeply grooved or pitted on the back, flattened on the inner surface, light brown and lustrous above, marked below by the large pale two-lobed hilums, and about an eighth of an inch long, with a thick bony outer coat, a thin firm light brown inner coat, and an embryo with two cotyledons.

Juniperus occidentalis grows on the mountain-slopes and high prairies of western Idaho and eastern Washington and Oregon and along the summits and upper slopes of the Cascade and Sierra Nevada Mountains southward to the San Bernardino Mountains in California. Standing, most often singly, on bald rocky mountain domes, and rarely descending below an altitude of six thousand feet, it attains its greatest trunk-diameter on the wind-swept peaks of the California Sierras, where it often

ascends to elevations of nearly ten thousand feet above the sea, standing like a sentinel with its massive stem and far-spreading branches impervious to the fiercest winter gales;[1] in the company of *Pinus Murrayana* and *Pinus albicaulis* it grows tall and symmetrical on rich moraine soil bordering alpine meadows; and in Bear Valley on the northern slope of the San Bernardino Mountains, between six and seven thousand feet above the sea-level, it forms a nearly pure forest of considerable extent.[2]

The wood of *Juniperus occidentalis* is light, soft, very close-grained, and exceedingly durable in contact with the soil; it is light red or brown, with thick nearly white sapwood, and contains thin inconspicuous bands of small summer-cells and numerous very obscure medullary rays. The specific gravity of the absolutely dry wood is 0.5765, a cubic foot weighing 35.93 pounds. It is used for fencing and fuel.[3]

The fruit is gathered and eaten by the Indians of California.[4]

Juniperus occidentalis was discovered in 1806 by Lewis and Clark on the mountains of the basin of the Columbia River.[5]

[1] Mr. John Muir (*The Mountains of California*, 204, f.) points out the fact that *Juniperus occidentalis* has such a hold on the ground and offers such resistance to the elements that "it dies standing, and wastes insensibly out of existence like granite, the wind exerting as little control over it alive or dead as it does over a glacier boulder."

[2] S. B. Parish, *Zoë*, iv. 353.

[3] Palmer, *Am. Nat.* xii. 594.

[4] *Juniperus occidentalis* grows very slowly, especially on exposed rocky slopes, and Muir (*l. c.*) believes that some of the old specimens on the Sierra Nevada are over two thousand years of age. The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is twenty-three inches in diameter inside the bark, and shows only one hundred and thirteen layers of annual growth, the tree from which it was cut having, after the first forty years, increased rapidly and regularly, many annual layers being an eighth of an inch thick. On this specimen the sapwood is seven and a quarter inches in thickness with eighty-six layers of annual growth.

[5] In Coues's edition of the Journal of Lewis and Clark no mention is made of this Juniper, but it was described by Pursh from specimens brought back by this expedition.

EXPLANATION OF THE PLATE.

PLATE DXXI. JUNIPERUS OCCIDENTALIS.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A flowering branch of the pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. A fruiting branch, natural size.
7. A fruit with part of the flesh removed, enlarged.
8. A seed, enlarged.
9. Vertical section of a seed, enlarged.
10. An embryo, enlarged.
11. End of a branchlet, enlarged.
12. End of a leaf, enlarged.

C.E. Faxon del. Himely sc.

JUNIPERUS OCCIDENTALIS, Hook.

A. Riocreux, dirext. Imp. J. Taneur, Paris.

JUNIPERUS MONOSPERMA.

Juniper.

FRUIT small, globose or oblong; seeds 1 or rarely 2. Leaves acute or acuminate at the apex, usually eglandular. Branchlets slender.

Juniperus monosperma.

Juniperus occidentalis, Parlatore, *De Candolle Prodr.* xvi. pt. ii. 489 (in part) (not Hooker) (1868). — Watson, *King's Rep.* vi. 336.

Juniperus occidentalis, *β* **monosperma**, Engelmann, *Trans. St. Louis Acad.* iii. 590 (1877); *Rothrock Wheeler's Rep.* vi. 263. — Veitch, *Man. Conif.* 289. — Rusby, *Bull. Torrey Bot. Club*, ix. 79. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 181. — Coulter, *Man. Rocky Mt. Bot.* 410. — Beissner, *Handb. Nadelh.* 129. — Masters, *Jour. R. Hort. Soc.* xiv. 213. — Lemmon, *West-American Cone-Bearers*, 80.

Juniperus Virginiana, Rothrock, *Wheeler's Rep.* vi. 6 (not Linnæus) (1878).

Juniperus occidentalis, var. **gymnocarpa**, Lemmon, *West-American Cone-Bearers*, 80 (1895).

A tree, occasionally forty or fifty feet tall, with a stout much-lobed and buttressed trunk sometimes three feet in diameter, short stout branches which form an open and very irregular head, and often with one or two branches near the ground much more developed than the others; or most frequently sending up numerous contorted stems which form a broad open unsightly bush from ten to twenty feet in height. The bark of the trunk is thin, ashy gray, divided into irregular narrow connected ridges which break up into long narrow persistent shreddy scales, disclosing by their separation the red-brown inner bark. The branchlets are slender and covered after the falling of the leaves with light red-brown bark which splits freely into thin loose scales. The leaves are disposed in pairs or rarely in threes and are often slightly spreading at the apex; they are ovate, acute or occasionally acuminate, much thickened and rounded on the back, usually eglandular but occasionally furnished with rather obscure dorsal glands, gray-green, and rather less than an eighth of an inch in length, and turn a bright red-brown before they fall; those on vigorous shoots and on younger plants are ovate, acute, tipped with long rigid points, thin, conspicuously glandular on the back, and often half an inch in length. The staminate flower consists of from eight to twelve stamens with broadly ovate rounded connectives or anther-scales slightly erose on the margins. The fruit is globose or oblong, from an eighth to a quarter of an inch long, and dark blue or occasionally copper-colored, with a thick firm epidermis covered by a conspicuous glaucous bloom, thin sweetish resinous flesh from which on some individuals the seed protrudes, and with one or rarely with two or three seeds. The seed is broadly ovate, often four-angled, with numerous slender grooves between the ridges, light chestnut-brown, lustrous at the somewhat obtuse apex, and marked below with the large pale two-lobed hilum; it has a comparatively thin and brittle outer wall, a pale brown membranaceous inner seed-coat, and an embryo with two cotyledons.

Juniperus monosperma is distributed from the divide between the Platte and Arkansas Rivers at the eastern base of the Rocky Mountains of Colorado, where, accompanied by the Nut Pine and the Yellow Pine, it clothes with an open stunted forest arid slopes between 5,500 and 7,000 feet above the sea-level, southward along the foothills of the Rocky Mountains to the mountain ranges of western Texas; it is common and the prevailing Juniper over the whole of the Colorado plateau, where in southern Colorado and Utah and in northern and central New Mexico and Arizona it often covers, usually with the Nut Pine or occasionally alone, great areas of rolling hills from six to seven thousand feet above the sea-level, forming a forest belt just above the desert and below the belt in which the Yellow Pine is the predominating tree,[1] and probably reaching its largest size in northern Arizona; it

[1] Merriam, *North American Fauna*, No. 3, 120.

grows at high elevations on the mountain ranges of southern Nevada,[1] and as a bush on the upper slopes of those of southern New Mexico and Arizona, where it is small and not abundant,[2] and of northern Mexico.

The wood of *Juniperus monosperma* is heavy, rather soft, close-grained, slightly fragrant, and very durable in contact with the soil; it contains numerous obscure medullary rays and thin inconspicuous bands of small summer-cells, and is light reddish brown, with nearly white sapwood and very eccentric layers of annual growth. The specific gravity of the absolutely dry wood is 0.7118, a cubic foot weighing 44.36 pounds. It is largely used for fencing, and furnishes the cheapest and most available fuel over much of the great arid territory which this Juniper inhabits.

The fruit is gathered, ground, and baked into bread by the Indians, who utilize the thin strips of fibrous bark in making saddles, breech-cloths, skirts, and sleeping-mats.[3]

Juniperus monosperma was introduced into the Arnold Aboretum in 1882, and has proved hardy in eastern New England.

Formerly united with *Juniperus occidentalis* of the Pacific coast region, *Juniperus monosperma* differs from that species in its habit, in its thinner branchlets, and in its smaller and usually one-seeded fruit, and also in its range, and is best considered specifically distinct.

[1] Merriam, *North American Fauna*, No. 7, 343 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 225 (*Bot. Death Valley Exped.*).

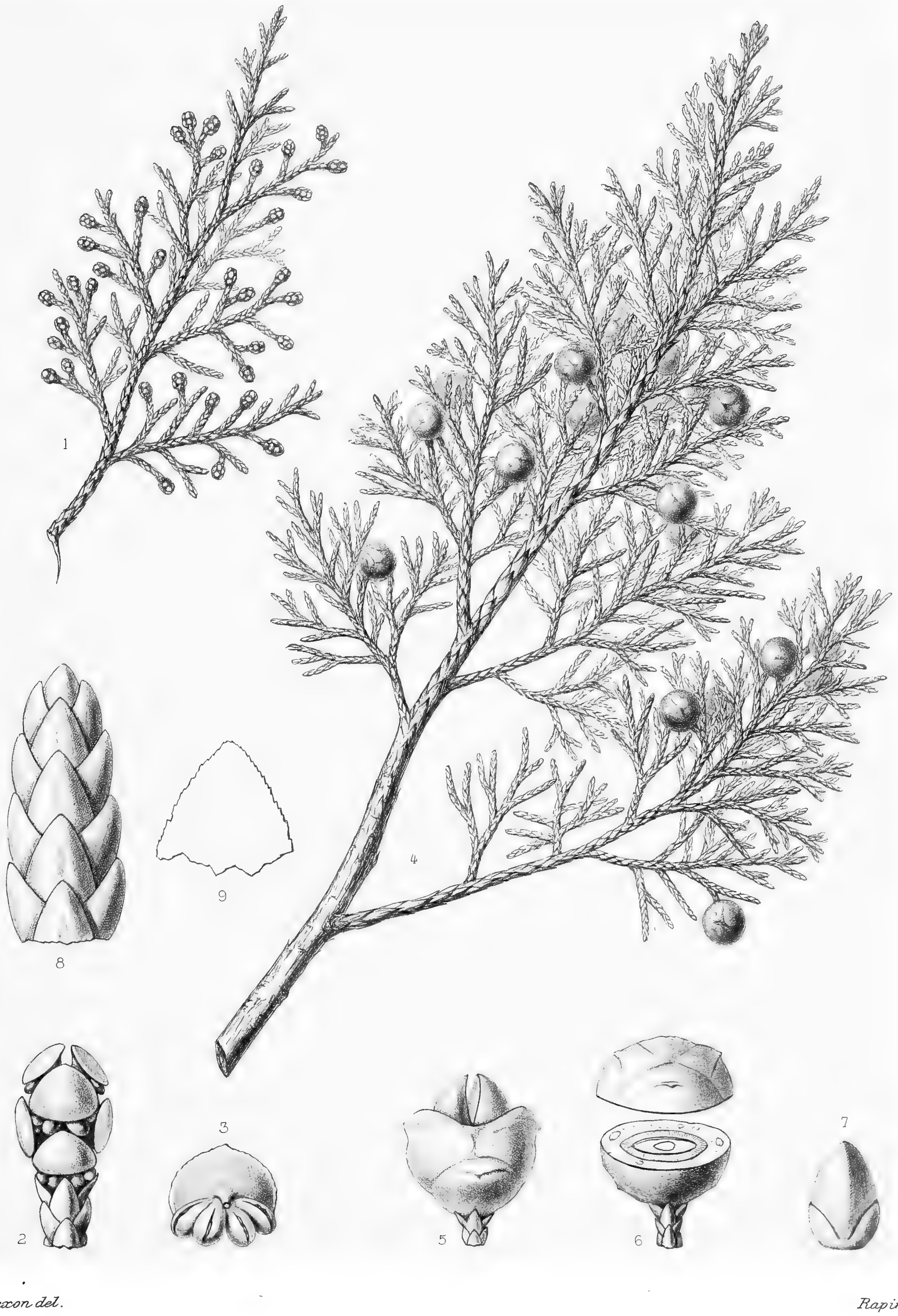
[2] In 1894 *Juniperus monosperma* was collected by Professor J. W. Toumey on the high slopes of the Santa Rita and Chiricahua Mountains of Arizona.

[3] *Rep. U. S. Dept. Agric.* 1870, 411. — Palmer, *Am. Nat.* xii. 594.

EXPLANATION OF THE PLATE.

PLATE DXXII. JUNIPERUS MONOSPERMA.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, enlarged.
4. A fruiting branch, natural size.
5. A fruit with protruding seeds, enlarged.
6. A fruit laid open transversely, enlarged.
7. A seed, enlarged.
8. End of a branchlet, enlarged.
9. End of a leaf, enlarged.



C.E. Faxon del. Rapine sc.

JUNIPERUS MONOSPERMA, Sarg.

A. Riocreux direx.t Imp. J. Taneur, Paris.

JUNIPERUS SABINOIDES.

Cedar. Rock Cedar.

FRUIT small, globose; seeds 1 to 4. Leaves opposite, obtuse or rarely acute. Branchlets slender, sharply quadrangular.

Juniperus sabinoides (not Endlicher nor Grisebach).

Cupressus sabinoides, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 3 (1817). — Kunth, *Syn. Pl. Æquin.* i. 351.

Juniperus Mexicana, Sprengel, *Syst.* iii. 909 (1826).

Juniperus tetragona, Schlechtendal, *Linnæa*, xii. 495 (1838). — Bentham, *Pl. Hartweg.* 57. — Endlicher, *Syn. Conif.* 29. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 202. — Knight, *Syn. Conif.* 12. — Carrière, *Traité Conif.* 50. — Gordon, *Pinetum*, 120. — Henkel & Hochstetter, *Syn. Nadelh.* 346. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 491. — Engelmann, *Trans. St. Louis Acad.* iii. 340. — Hemsley, *Bot. Biol. Am. Cent.* iii. 184. — Beissner, *Handb. Nadelh.* 115.

Sabina tetragona, Antoine, *Cupressineen-Gattungen*, 40, t. 53 (1857).

Juniperus occidentalis, var. **Texana**, Vasey, *Rep. U. S. Dept. Agric.* 1875, 185 (*Cat. Forest Trees U. S.*) (1876).

Juniperus occidentalis, var.? γ **conjungens**, Engelmann, *Trans. St. Louis Acad.* iii. 590 (1877). — Veitch, *Man. Conif.* 289. — Watson, *Proc. Am. Acad.* xviii. 158. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 182. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 556 (*Man. Pl. W. Texas*).

Juniperus tetragona, var. **oligosperma**, Engelmann, *Trans. St. Louis Acad.* iii. 591 (1877).

A tree, in Texas occasionally forty feet, but generally not more than twenty feet in height, with a short or rarely elongated slightly lobed trunk, seldom exceeding a foot in diameter, and small spreading branches which form a wide round-topped open and irregular or a narrow pyramidal head; or often shrubby, with numerous spreading stems. The bark of the trunk is from one quarter to one half of an inch in thickness, brown tinged with red, and divided into long narrow slightly attached scales, which, persistent for many years, clothe it with a loose thatch-like covering; on the young stems and on the branches it is gray tinged with red, and covered with a network of narrow flat plates, scaly on the surface, and broken along the margins into thin pale shreds. The branchlets are slender, sharply quadrangular, and after the fall of the leaves become terete, light reddish brown or ashy gray, with smooth or slightly scaly bark. The leaves are four-ranked, closely appressed, thickened and carinate on the back, obtuse or acute at the apex, slightly denticulate on the margins, usually eglandular, rather more than a sixteenth of an inch long, and dark blue-green; those on vigorous young shoots and on seedling plants are lanceolate, long-pointed, rigid, and from one quarter to one half of an inch in length. The flowers appear from January in Texas until April on the mountains of Mexico. The staminate flower is composed of from twelve to eighteen stamens with ovate obtuse or slightly cuspidate connectives or anther-scales. The scales of the pistillate flower are ovate, acute and spreading, and very conspicuous when the fruit is half grown, but obliterated when it attains its full size. The fruit is subglobose, from a quarter to a third of an inch in diameter, and dark blue, with a thin epidermis covered by a glaucous bloom, sweet resinous flesh, and one or rarely two seeds. The seed is broadly ovate, acute, slightly or conspicuously ridged, rarely tuberculate, flattened on the inner surface by mutual pressure when more than one is formed, dark chestnut-brown and lustrous, nearly a quarter of an inch long and an eighth of an inch thick, with a small hilum, which does not extend far above the base, a thin outer coat, a membranaceous dark brown inner coat, and an embryo with two cotyledons.

Juniperus sabinoides, in the valley of the Colorado River in central Texas, in the neighborhood of Austin, covers great areas of low limestone hills, with nearly pure forests, and ranges southward and westward over the low rolling Texas hills; and in Mexico, where it is of small size, and usually shrubby

in habit, it spreads at high elevations over the mountains of Nuevo Leon, Coahuila, Chihuahua, and San Luis Potosí, and southward to the mountains in the neighborhood of the City of Mexico, ascending the high peaks of central Mexico to the limits of vegetation.[1]

The wood of *Juniperus sabinoides* from Texas is light, hard, not strong, close-grained, slightly fragrant, and very durable in contact with the soil; it is slightly fragrant, and brown, often streaked with red, with thin nearly white sapwood, and contains numerous obscure medullary rays and thin dark-colored conspicuous bands of small summer-cells.[2] The specific gravity of the absolutely dry wood is 0.6907, a cubic foot weighing 43.04 pounds. It is largely used for fencing, fuel, telegraph-poles, and railway-ties.

Discovered by Humboldt on the mountains in the state of Mexico, *Juniperus sabinoides* appears to have been first noticed in Texas by Berlandier.[3]

[1] Pringle, *Garden and Forest*, i. 141, 441; iii. 338.

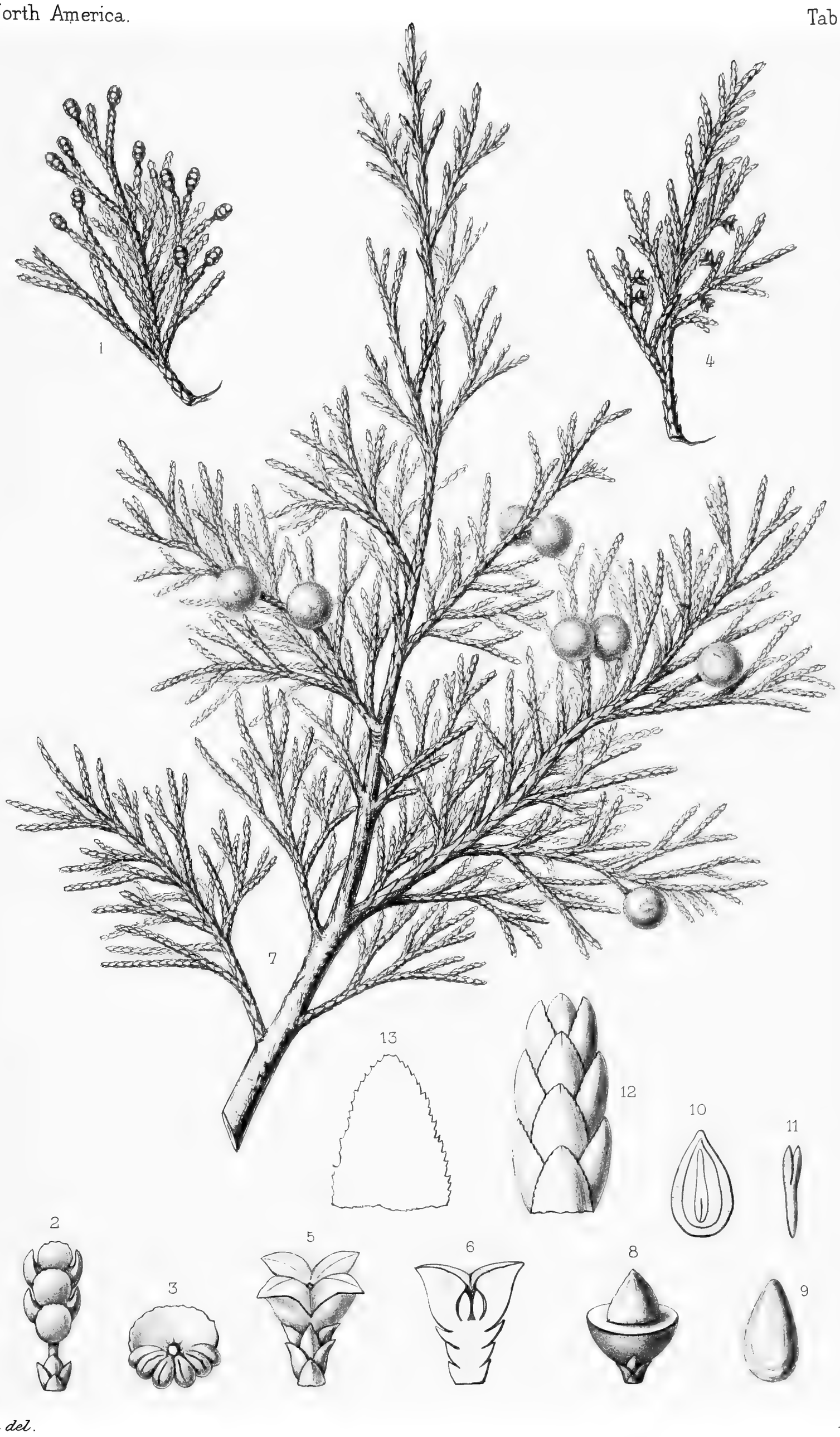
[2] The specimen of *Juniperus sabinoides* in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is nine and a quarter inches in diameter inside the bark, with one hundred and fifteen layers of annual growth, twenty being of sapwood.

[3] See i. 82.

EXPLANATION OF THE PLATE.

PLATE DXXIII. JUNIPERUS SABINOIDES.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A branch of the pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. Vertical section of a pistillate flower, enlarged.
7. A fruiting branch, natural size.
8. A fruit with part of the fleshy covering removed, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. End of a branchlet, enlarged.
13. End of a leaf, enlarged.



C.E. Faxon del. *Rapine sc.*

JUNIPERUS SABINOIDES, Sarg.

A. Riocreux, direx.t *Imp. J. Taneur, Paris.*

JUNIPERUS VIRGINIANA.

Red Cedar. Savin.

FRUIT small, subglobose; seeds 1 to 4. Leaves opposite, acute or rarely obtuse, glandular. Branchlets slender.

Juniperus Virginiana, Linnæus, *Spec.* 1039 (1753). — Du Roi, *Harbk. Baumz.* i. 346. — Wangenheim, *Beschreib. Nordam. Holz.* 51; *Nordam. Holz.* 9, t. 2, f. 5. — Schoepf, *Mat. Med. Amer.* 151. — Marshall, *Arbust. Am.* 70. — Moench, *Bäume Weiss.* 55. — Evelyn, *Silva*, ed. Hunter, ii. 11. — Burgsdorf, *Anleit.* pt. ii. 122. — Walter, *Fl. Car.* 248. — Castiglioni, *Viag. negli Stati Uniti*, ii. 266. — Willdenow, *Berl. Baumz.* 157; *Spec.* iv. pt. ii. 853; *Enum.* 1023. — Lamarck, *Dict.* ii. 627. — Borkhausen, *Handb. Forstbot.* i. 767. — Michaux, *Fl. Bor.-Am.* ii. 245. — Persoon, *Syn.* ii. 632. — Desfontaines, *Hist. Arb.* ii. 559. — Schlümbach, *Abbild. Nadelbäume*, 98, t. 15. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 445. — Michaux f. *Hist. Arb. Am.* iii. 42, t. 5. — Bigelow, *Fl. Boston.* 242; *Med. Bot.* iii. 49, t. 45. — Nuttall, *Gen.* ii. 245. — Elliott, *Sk.* ii. 717. — Jaume St. Hilaire, *Traité des Arbres Forestiers*, t. 36. — Sprengel, *Syst.* iii. 908. — Richard, *Comm. Bot. Conif.* 37, t. 6, f. 2. — Rafinesque, *Med. Fl.* ii. 13. — Audubon, *Birds*, t. 43. — Forbes, *Pinetum Woburn.* 199. — Torrey, *Fl. N. Y.* ii. 235; *Pacific R. R. Rep.* iv. pt. v. 142. — Emerson, *Trees Mass.* 102; ed. 2, i. 118, t. — Endlicher, *Syn. Conif.* 27 (in part). — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 202. — Knight *Syn. Conif.* 12. — Darlington, *Fl. Cestr.* ed. 3, 295. — Carrière, *Traité Conif.* 43. — Gordon, *Pinetum*, 112. — Cooper, *Am. Nat.* iii. 413. — Chapman, *Fl.* 435. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 71. — Henkel & Hochstetter, *Syn. Nadelh.* 334. — (Nelson) Senilis, *Pinaceæ*, 153. — Hoopes, *Evergreens*, 291. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 488. — Nördlinger, *Forstbot.* 471, f. — Engelmann, *Trans. St. Louis Acad.* iii. 591; *Rothrock Wheeler's Rep.* vi. 263. — K. Koch, *Dendr.* ii. pt. ii. 138. — Watson, *King's Rep.* v. 335. — Porter & Coulter, *Fl. Colorado; Hayden's Surv. Misc. Pub.* No. 4, 132. — Veitch, *Man. Conif.* 282. — Ridgway, *Proc. U. S. Nat. Mus.* v. 87. — Regel, *Russ. Dendr.* ed. 2, 15. — Hemsley, *Bot. Biol. Am. Cent.* iii. 184. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 182. — Willkomm, *Forst. Fl.* ed. 2, 257. — Watson & Coulter, *Gray's Man.* ed. 6, 494. — Beissner, *Handb. Nadelh.* 122, f. 30. — Masters, *Jour. R. Hort. Soc.* xiv. 215. — Hansen, *Jour. R. Hort. Soc.* xiv. 298 (*Pinetum Danicum*).

Juniperus Caroliniana, Miller, *Dict.* ed. 8, No. 4 (1768). — Muenchhausen, *Hausv.* v. 183. — Du Roi, *Harbk. Baumz.* i. 346. — Marshall, *Arbust. Am.* 71. — Burgsdorf, *Anleit.* pt. ii. 123.

Juniperus arborescens, Moench, *Meth.* 699 (1794).

Juniperus fragrans, Salisbury, *Prodr.* 397 (1796). — Knight, *Syn. Conif.* 13.

Juniperus Virginiana, β Caroliniana, Willdenow, *Berl. Baumz.* 157 (1796). — Hayne, *Dendr. Fl.* 205. — Loudon, *Arb. Brit.* iv. 2495.

Juniperus Barbadensis, Michaux, *Fl. Bor.-Am.* ii. 246 (not Linnæus) (1803). — Pursh, *Fl. Am. Sept.* ii. 647. — Nuttall, *Gen.* ii. 245; *Sylva*, iii. 96.

Juniperus Virginiana Hermanni, Persoon, *Syn.* ii. 632 (1807).

Juniperus Virginiana, α vulgaris, Hayne, *Dendr. Fl.* 205 (1822). — Endlicher, *Syn. Conif.* 28.

Juniperus Hermanni, Sprengel, *Syst.* iii. 908 (1826).

Juniperus Bermudiana, Rafinesque, *Med. Fl.* ii. 13 (in part) (not Linnæus) (1830).

Juniperus fœtida, η Virginiana, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 298 (*Révision des Juniperus*) (1841); *Hist. Vég.* xi. 318.

Juniperus Virginiana, B australis, Endlicher, *Syn. Conif.* 28 (1847).

Sabina Virginiana, Antoine, *Cupressineen-Gattungen*, 61, t. 83, 84 (1857).

Juniperus Virginiana, var. **Bermudiana**, Vasey, *Rep. U. S. Dept. Agric.* 1875, 185 (*Cat. Forest Trees U. S.*) (1876).

Juniperus Virginiana, var. **montana**, Vasey, *Rep. U. S. Dept. Agric.* 1875, 185 (*Cat. Forest Trees U. S.*) (1876).

Juniperus occidentalis, Macoun, *Cat. Can. Pl.* 461 (1886) (not Hooker) (1884).

A tree, occasionally one hundred feet tall, with a long straight trunk three or four feet in diameter, often lobed and eccentric, and frequently buttressed toward the base, but usually much smaller, and averaging forty or fifty feet in height, and with short slender branches, horizontal on the lower part of the tree, erect above, and forming a narrow compact pyramidal head of tufted foliage, which in old age usually becomes broad and round-topped or irregular; or with long slightly pendulous branches forming a broad open graceful crown; or occasionally reduced to a low shrub with decumbent stems. The bark

of the trunk is from an eighth to a quarter of an inch in thickness, light brown tinged with red, and separated into long narrow scales, fringed on the margins, and persistent for many years. The branchlets are slender and four-angled, but after the disappearance of the leaves become terete, and are covered with close dark brown bark tinged with red or gray, or occasionally with brighter red slightly scaly bark. The leaves are opposite in pairs, closely appressed, acute, acuminate with short slender points or occasionally obtuse, rounded and eglandular or often glandular on the back, entire, about one sixteenth of an inch long, and dark blue-green or glaucous, turning russet or yellow-brown during the winter at the north, beginning usually in their third season to grow hard and woody, and remaining for two or three years longer on the branches; those of young plants and vigorous branches are linear-lanceolate, long-pointed, light yellow-green, eglandular, and from one half to three quarters of an inch in length. The flowers are dicœcious or very rarely moncœcious, opening after the first warm days of spring from February at the south to May at the north. The staminate flower is about an eighth of an inch long, with from ten to twelve stamens, their connectives or anther-scales being rounded and entire, with four or occasionally five or six pollen-sacs. The scales of the pistillate flower are spreading and acute, and become obliterated from the fruit. This is subglobose, from a quarter to a third of an inch in diameter, pale green when fully grown, and dark blue and covered with a glaucous bloom at maturity, with a firm epidermis, thin sweetish resinous flesh, and one or two or rarely three or four seeds.[1] The seeds are ovate, acute and occasionally apiculate at the apex, nearly terete, or variously angled and grooved, light chestnut-brown and lustrous, marked below with comparatively small two-lobed hilums, and from one sixteenth to nearly one eighth of an inch in length, with a thick bony outer coat, a pale brown membranaceous inner coat, and an embryo with two cotyledons.

Juniperus Virginiana, which is the largest and most valuable of the American Junipers, is the most widely distributed coniferous tree of North America. From southern Nova Scotia and New Brunswick it ranges southward to Cape Malabar and the shores of Tampa Bay, Florida, westward to the valley of the lower Ottawa River and the shores of Georgian Bay,[2] eastern Dakota,[3] central Nebraska[4] and Kansas,[5] the Indian Territory, and the valley of the Colorado River in Texas, and from the Black Hills of Dakota and the hills of northern and western Nebraska through the mountain regions of Montana, Idaho, northern Washington, and southern British Columbia to Vancouver's Island, and southward along the Rocky Mountains to northern New Mexico and to Utah, Nevada, and northern Arizona.[6] Comparatively rare in the maritime provinces of Canada, and in Quebec, where it is usually confined to rocky river banks, ascending for some distance the streams flowing into the St. Lawrence above Montreal, it is generally found in similar situations in Ontario, but is more common, especially in the neighborhood of the Bay of Quente, covering large areas around its shores. In the northern, middle, and south Atlantic states *Juniperus Virginiana* is scattered over dry gravelly slopes and rocky ridges often immediately on the seacoast, resisting with its stunted stem and short tough branches the fiercest gales, or grows in rich soil by the borders of highways and fences, when birds have scattered its seeds, but does not ascend the mountains of New England and New York nor the high Alleghanies; in middle Kentucky and Tennessee and in northern Alabama and Mississippi it covers great areas of low rolling limestone hills, with nearly pure forests of small bushy trees; in the coast region of the eastern Gulf states it grows in deep swamps to a large size, becoming a tall wide-topped tree, with graceful somewhat pendulous branches; in western Louisiana, Texas, and southern Arkansas

[1] The statement universally made that the fruit of *Juniperus Virginiana* does not ripen until the second season is probably correct for some parts of the country, but Mr. J. G. Jack has noticed that the trees in the neighborhood of Boston ripen their fruit during the first autumn (*Bot. Gazette*, xviii. 372).

[2] Brunet, *Cat. Vég. Lig. Can.* 60. — Provancher, *Flore Canadienne*, ii. 559. — Macoun, *Cat. Can. Pl.* 462.

[3] Williams, *Bull. No.* 43 *South Dakota Agric. College*, 103.

[4] Bessey, *Rep. Nebraska State Board Agric.* 1894, 101.

[5] Mason, 8*th Bienn. Rep. State Board Agric. Kansas*, 273.

[6] *Juniperus Virginiana* was collected on the upper slopes of the Grand Cañon of the Colorado by J. W. Toumey and C. S. Sargent in September, 1894.

it attains its greatest dimensions on rich alluvial bottom-lands, and in Kansas and eastern and central Nebraska grows usually on dry limestone river-bluffs, where, before the coming of white men, it often formed groves of considerable extent. Farther west it is smaller, and is usually scattered in isolated individuals along the rocky banks of cañons and lakes, generally at elevations of six or seven thousand feet above the sea, sometimes, in the valley of the Columbia River in southern British Columbia, growing in bogs;[1] in Utah, Nevada, and Arizona it is exceedingly rare.

The wood of *Juniperus Virginiana* is light, soft, close-grained, brittle, and not strong; it contains numerous very obscure medullary rays and broad conspicuous bands of small summer-cells, and is dull red, with thin nearly white sapwood, very fragrant, easily worked, and extremely durable in contact with the soil. The specific gravity of the absolutely dry wood is 0.4826, a cubic foot weighing 30.70 pounds. It is largely used for posts and railway-ties, the sills of buildings and the interior finish of houses, and for lining closets and chests in which woolens are preserved against the attacks of moths;[2] it is also employed in cabinet-making and almost exclusively in the manufacture of lead-pencils,[3] while its lightness, durability, cheerful color, and pleasant fragrance recommend it to the makers of pails and tubs and many other small articles.

A decoction of the fruit and leaves is occasionally used medicinally, and an infusion of the berries as a diuretic,[4] and in homœopathic remedies.[5] Oil of Red Cedar is distilled from the leaves and wood, and is used principally in perfumery.[6]

The virtue of the Red Cedar was extolled in Morton's *New English Canaan*, published in 1632;[7] and other early European travelers praised its qualities; it was described in 1640 by Parkinson,[8] who united it with the Juniper of Bermuda, and, according to Aiton,[9] it was introduced into English gardens in 1664.

[1] Macoun, *Cat. Can. Pl.* 462 (*Juniperus occidentalis*).

[2] "The Dust and Shavings of *Cedar*, laid amongst Linnen or Woollen, destroys the moth and all Verminous Insects: It never rots, breeding no Worm, by which many other Woods are consumed and destroyed. Of *Cedar* there are many sorts; this in *Carolina* is esteemed of equal Goodness for Grain, Smell and Colour with the *Bermudian Cedar*, which of all the *West Indian* is esteemed the most excellent." (Thomas Ashe, *Carolina, or a Description of the Present State of that Country*, 5.)

[3] The straightest grained and most easily worked Cedar wood is obtained from the swamps near the western coast of the Florida peninsula, and large factories have been established at Cedar Keys, Florida, and at other points in the southern states, by German manufacturers, to cut up the wood for pencil-making.

[4] Jenks, *Am. Jour. Pharm.* xiv. 235. — Johnson, *Man. Med. Bot. N. Am.* 261.

An ointment is prepared by boiling the fresh leaves of *Juniperus Virginiana* with lard, which is occasionally employed in the United States as a substitute for savine cerate in the treatment of blisters, and the powdered leaves are used for the same purpose (*U. S. Dispens.* ed. 16, 1833).

Cases of poisoning from the use of the volatile oil, which has a reputation for producing abortion, are recorded. (See *Boston Med. and Surg. Jour.* xl. 469.)

[5] Millspaugh, *Am. Med. Pl. in Homœopathic Remedies*, ii. 166, t. 166.

[6] Burkett, *Proc. Linn. Soc.* i. 58.

[7] "Cedar, of this sorte there is abundance; and this wood was such as Saloman used for the building of that glorious temple at Hierusalem; . . . this wood cutts red, and is cut for bedsteads, tables and chests, and may be placed in the Catalogue of commodities." (Force, *Hist. Coll.* ii. No. 5, 44.)

"There are oaks of very close grain; yea, harder than any in this country, as thick as three or four men. There is Red-wood which being burned, smells very agreeably; when men sit by the fire on benches made from it, the whole house is perfumed by it. When they keep watch by night against their enemies then they place it (the fire) in the centre of their huts to warm their feet by it; they do not sit, then, up in the tree, but make a hole in the roof, and keep watch there to prevent attacks." (*Documentary History of New York*, iii. 40.)

"Juniper, which *Cardanus* saith is Cedar in hot Countries, and Juniper in cold Countries; it is hear very dwarfish and shrubby, growing for the most part by the Seaside." (Josselyn, *New England Rarities*, 95.)

This probably relates in part to *Juniperus communis*.

"Juniper grows for the most part by the Sea-side, it bears abundance of skie-coloured berries fed upon by Partridges, and hath a woody root. . . . They write that Juniper-coals preserve fire longest of any, keeping fire a whole year without supply, yet, the *Indian* never burns of it." (Josselyn, *Account of Two Voyages to New England*, 71.)

[8] *Juniperus major Americana, Theatr.* 1029 (in part).

Cedrus Americana vulgo dicta. Juniperus Virginiana & Barbadensis, Ray, *Hist. Pl.* ii. 1413 (in part).

Juniperus Virginiana Cupressi foliis rarioribus acutis Sabinam redolens, Plukenet, *Alm. Bot.* 201.

Juniperus; Virginiana. Folio ubique, Juniperino. Cedrus; Virginiana, Boerhaave, *Ind. Alt. Hort. Ludg. Bat.* ii. 208. — Duhamel, *Traité des Arbres*, i. 322.

Juniperus; Virginiana; foliis inferioribus juniperinis, superioribus Sabinam, vel Cypressum, referentibus, Boerhaave, *l. c.* — Duhamel, *l. c.*

Juniperus foliis basi adnatis: junioribus imbricatis, senioribus patulis, Linnæus, *Hort. Cliff.* 464 (excl. syn. Plukenet & Sloane). — Royen, *Fl. Leyd. Prodr.* 90. — Clayton, *Fl. Virgin.* 194.

[9] *Hort. Kew.* iii. 414. — Loudon, *Arb. Brit.* iv. 2495, f. 2357.

For two centuries *Juniperus Virginiana* has been a favorite garden plant, and numerous forms, varying in habit and in the color of the foliage, have appeared in cultivation.[1] The Red Cedar is one of the most familiar and picturesque objects in the landscapes of the northeastern United States, and in this region it is better adapted than any other tree for the production of those formal effects, sometimes desired by artists in gardening, which are secured in more temperate climates by the use of the Cypress-trees of the Old World.[2]

[1] One of the best of the cultivated forms of *Juniperus Virginiana* known in European gardens is, —

Juniperus Virginiana gracilis.

Juniperus gracilis, Endlicher, *Syn. Conif.* 31 (1847).

Juniperus Gossainthanea, Carrière, *Traité Conif.* 56 (1855).

Juniperus Virginiana Barbadensis, Gordon, *Pinetum*, 114 (1858).

Juniperus Virginiana, γ *Bedfordiana*, Parlatore, *De Candolle Prodr.* xvi. pt. ii. 489 (1868). — Veitch, *Man. Conif.* 284. — Beissner, *Handb. Nadelh.* 124. — Hansen, *Jour. R. Hort. Soc.* xiv. 299 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 54.

The Bedford Juniper is distinguished by long slender somewhat pendulous branches and bright green foliage. It has long been an inhabitant of European gardens, where it is known, not only by its published names, but also as *Juniperus Bedfordiana* and *Juniperus Virginiana Caroliniana*. This tree has at different times been considered a native of Mexico, of the West Indies, and of India. Being rather tender in England, it is not improbable that the seed from which it was raised there originated in the swamps of Florida.

Forms with glaucous leaves, which are comparatively common on wild trees in the northeastern states, are distinguished in gardens as *Juniperus Virginiana*, β *glauca* (Carrière, *l. c.* 45 (1855). — Gordon, *l. c.* 113. — Parlatore, *l. c.* — Veitch, *l. c.* — Beissner, *l. c.* 126). This is the *Juniperus glauca* of Willdenow (*Enum.* Suppl. 67), of Link (*Enum. Hort. Berol.* ed. 2, ii. 435), and of many gardens.

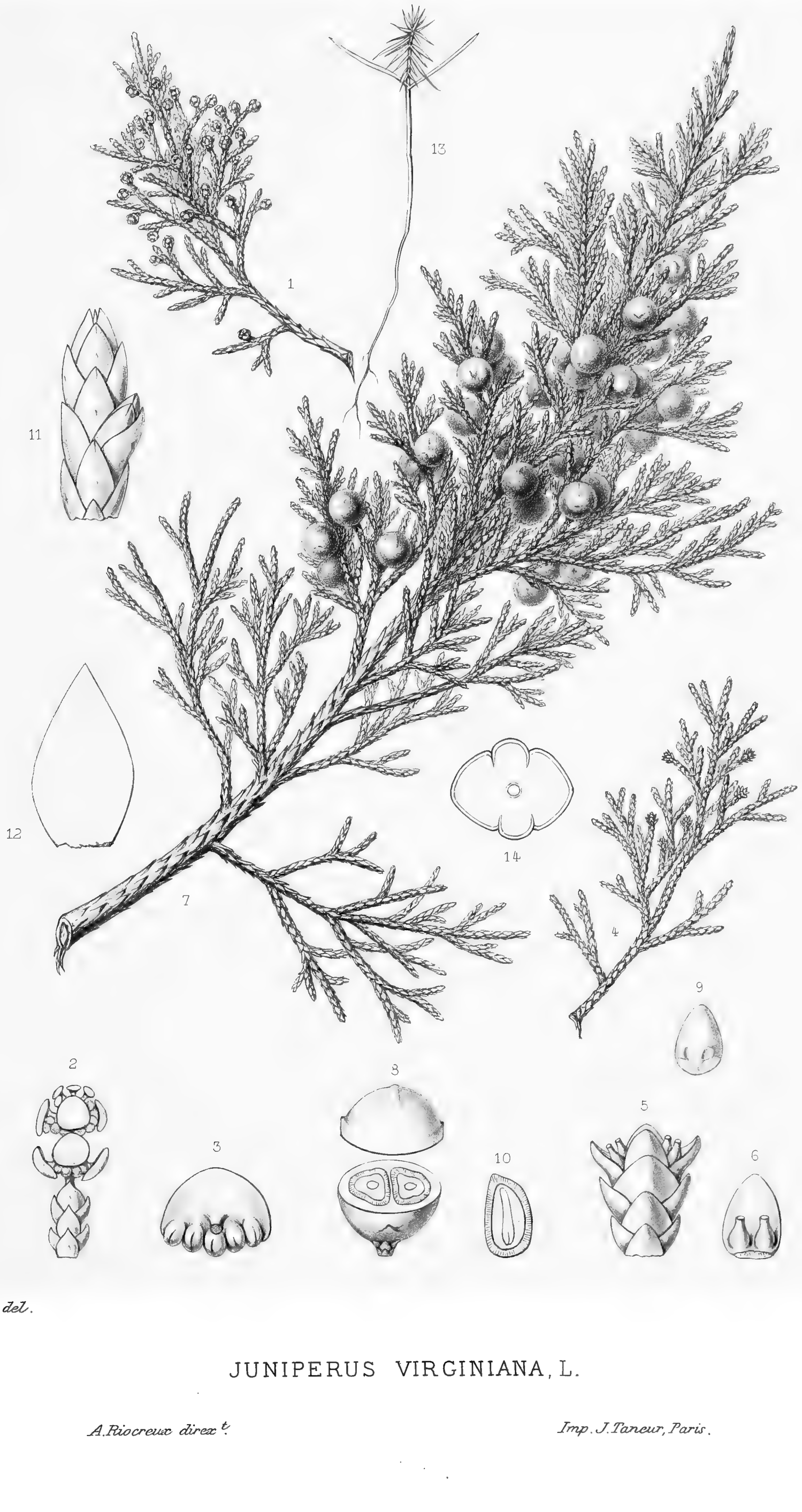
Other varieties of *Juniperus Virginiana* are described by Carrière (*l. c.* ed. 2, 45), Gordon (*l. c.* ed. 2, 155), and Veitch (*l. c.* 284). Most of the twenty-six varieties described by Beissner (*l. c.* 125) as cultivated in European nurseries scarcely vary from the type, or are distinguished from it by trivial peculiarities, the only really distinct forms of this tree in cultivation being those with pendulous branches, with a dwarf compact habit, and with glaucous or variegated leaves.

[2] *Forest Leaves*, ii. 148, t. — *Garden and Forest*, viii. 61, f. 9.

EXPLANATION OF THE PLATE.

PLATE DXXIV. JUNIPERUS VIRGINIANA.

1. A flowering branch of the staminate tree, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A branch of the pistillate tree, natural size.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower with its ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. A fruit divided transversely, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. End of a branchlet, enlarged.
12. A leaf, enlarged.
13. A seedling, natural size.
14. Cross section of a branchlet, enlarged.



C.E. Faxon del. Rapine sc.

JUNIPERUS VIRGINIANA, L.

A. Riocreux direx.t. Imp. J. Tanceur, Paris.

CUPRESSUS.

FLOWERS naked, monœcious, terminal, the staminate solitary; stamens numerous, opposite; anther-cells 2 to 6; the pistillate solitary or rarely clustered; scales opposite, bearing numerous or 1 to 5 ovules. Fruit a subglobose woody strobile. Leaves scale-like or subulate, persistent.

Cupressus, Linnæus, *Gen.* 294 (1737). — Adanson, *Fam. Pl.* ii. 480. — A. L. de Jussieu, *Gen.* 413. — Endlicher, *Gen.* 259. — Meisner, *Gen.* 352. — Bentham & Hooker, *Gen.* iii. 427. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 99. — Baillon, *Hist. Pl.* xii. 34 (in part). — Masters, *Jour. Linn. Soc.* xxx. 18; xxxi. 325.

Chamæcyparis, Spach, *Hist. Vég.* xi. 329 (1842). — Endlicher, *Gen.* Suppl. iv. pt. ii. 4. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 100.

Platycladus, Spach, *Hist. Vég.* xi. 333 (in part) (1842).

Thujopsis, Siebold & Zuccarini, *Fl. Jap.* ii. 32 (1842 ?).

Retinospora, Siebold & Zuccarini, *Fl. Jap.* ii. 36 (1842 ?).

Thuya, Bentham & Hooker, *Gen.* iii. 426 (in part) (not Linnæus) (1880). — Baillon, *Hist. Pl.* xii. 34 (in part).

Resinous often aromatic polymorphic trees, with thin and scaly or rarely thick and deeply furrowed bark, usually pale straight-grained durable frequently fragrant wood, spreading or erect branches, slender often deciduous branchlets, quadrangular (Eucupressus) or flattened and two-ranked in one horizontal plane (Chamæcyparis), naked buds, and fibrous roots. Leaves ovate, small, scale-like, decurrent and adnate on the stem, thickened, rounded or carinate and glandular or eglandular on the back, denticulate or entire, acute, acuminate or rounded and appressed or slightly spreading at the apex, decussately opposite, closely imbricated, or on leading shoots often remote by the lengthening of the nodes, usually dying and becoming brown and woody before falling; on vigorous sterile branchlets or young plants acicular or linear-lanceolate and spreading. Flowers minute, monœcious on separate branches, opening in early spring from buds formed the previous autumn. Staminate flower terminal on a leafy branch, oblong or cylindrical, composed of a subsessile axis bearing numerous decussately opposite stamens; filaments short, enlarged into ovate or orbicular subpeltate yellow, brown, or scarlet connectives bearing on their inner face from two to six globose two-valved pendulous anther-cells opening below longitudinally; pollen-grains simple. Pistillate flower terminal on a short axillary branch, solitary or rarely fascicled, subglobose, composed of ovate acute membranaceous peltate opposite scales verticillately disposed in from three to six ranks or decussate, those of the lower and sometimes of the upper ranks sterile, slightly thickened at the base on the inner surface by the ovuliferous scales bearing one to four or numerous free erect orthotropous bottle-shaped ovules. Fruit a short-stalked erect globose or subglobose strobile maturing the second or the first year, more or less rugose and glandular, often covered with a glaucous bloom, formed by the enlargement of the ovuliferous scales, abruptly dilated, clavate and flattened at the apex, or obpyramidal, bearing the remnants of the flower-scales developed into short central more or less thickened mucros or bosses, closed before maturity, ultimately opening at the apex of the scales, persistent on the branch after the discharge of the seeds. Seeds numerous, in several rows (Eucupressus), or from one to five (Chamæcyparis), erect on the slender stalk-like base of the scale, thick, acutely angled (Eucupressus), or subcylindrical and slightly compressed; seed-coat of two layers, produced into narrow or broad lateral wings, the outer thin and membranaceous, the inner thicker and crustaceous. Embryo axile, erect in copious fleshy equal albumen; radicle superior, shorter than the two or rarely three or four cotyledons turned away from the conspicuous or minute hilum.[1]

[1] The species of Cupressus may be grouped in the following sections: —

EUCUPRESSUS. Fruit large, maturing the second year; seeds numerous, in several rows with narrow wings, thick seed-coats, and conspicuous hilums; branchlets quadrangular; leaves denticulate. Inhabitants of California, Arizona, Mexico, Lower Califor-

Cupressus, of which about eighteen species can be distinguished, inhabits eastern and western North America, Mexico, and Lower California,[1] eastern Asia, the temperate Himalayas, the Levant, and southeastern Europe. Seven species are found in the territory of the United States; of these one is widely distributed in the Atlantic and Gulf coast regions, and the others are confined to the Pacific slope of the continent. The genus is an ancient one, existing in Greenland in the tertiary period and later extending into western Europe, from which it has now entirely disappeared.[2]

Many of the species of Cupressus produce wood esteemed in the arts, the most valuable timber-trees of the genus being the North American *Cupressus Lawsoniana*, *Cupressus Nootkatensis*, and *Cupressus thyoides*, the Japanese *Cupressus obtusa*[3] and *Cupressus pisifera*,[4] the Himalayan *Cupressus torulosa*, the Mexican *Cupressus Benthamii*, and the Chinese *Cupressus funebris*.

CHAMÆCYPARIS (Sections Chamæcyparis and Thuyopsis, Bentham & Hooker *Gen.* iii. 427). Fruit small, maturing the first year; seeds 1 to 4, with broad wings, thin seed-coats, and minute hilums; branchlets flattened, in one plane, often deciduous; leaves entire, those of the lateral ranks conduplicate, nearly covering those of the other ranks. Inhabitants of the coast regions of Atlantic and Pacific North America and of Japan.

[1] Hemsley, *Bot. Biol. Am. Cent.* iii. 183.

Little is known of the specific characters, distribution, or uses of the Mexican Cypresses which appear to be common in highland forests. Three species have been described, but two of them are perhaps merely forms of the same tree, and it is not improbable that the Arizona Cypress, included in this work, should be referred to one of the described Mexican species, although material to establish its identification is not available.

Cupressus Guadalupensis (Watson, *Proc. Am. Acad.* xiv. 300 [1879]. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 114), of Guadaloupe Island and the mainland of Lower California, although sometimes considered a variety of the California *Cupressus macrocarpa* (*Cupressus macrocarpa*, var. *Guadaloupensis*, Masters, *Gard. Chron.* ser. 3, xviii. 62, f. 9, 11, 12 [1895]), appears distinct in its more flaky bark, more slender branchlets, and glaucous and more glandular foliage.

This beautiful tree has been cultivated for the last twenty years in several gardens near San Francisco, and has been introduced into Europe.

[2] Saporta, *Origine Paléontologique des Arbres*, 98. — Zittel, *Handb. Palæontolog.* ii. 323, 325.

[3] K. Koch, *Dendr.* ii. pt. ii. 168 (1873). — Masters, *Jour. R. Hort. Soc.* xiv. 207.

Retinospora obtusa, Siebold & Zuccarini, *Fl. Jap.* ii. 38, t. 121 (1842?).

Chamæcyparis obtusa, Endlicher, *Syn. Conif.* 63 (1847). — Miquel, *Ann. Mus. Lugd. Bat.* iii. 168 (*Prol. Fl. Jap.*). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 466. — Franchet & Savatier, *Enum. Pl. Jap.* i. 471. — Beissner, *Handb. Nadelh.* 92. — Hansen, *Jour. R. Hort. Soc.* xiv. 281 (*Pinetum Danicum*).

Chamæcyparis breviramea, Maximowicz, *Bull. Acad. Sci. St. Pétersburg*, x. 489 (*Mél. Biol.* vi. 25) (1866). — Franchet & Savatier, *l. c.* 470. — Beissner, *l. c.* 97.

Chamæcyparis pendula, Maximowicz, *l. c.* (*l. c.*) (1866). — Franchet & Savatier, *l. c.* 471. — Beissner, *l. c.* 98.

Thuya obtusa, Masters, *Jour. Linn. Soc.* xviii. 491 (*Conifers of Japan*) (1881).

Cupressus obtusa, var. *breviramea*, Masters, *Jour. R. Hort. Soc. l. c.* (1892).

Cupressus obtusa, the Hi-no-ki of the Japanese, a native of the southern mountain provinces, is the most valuable coniferous timber-tree of Japan. Sacred to the disciples of the Shintō faith, it is planted in the neighborhood of Shintō temples, which are built of its wood; and it is also largely cultivated for its timber in central Japan, usually at elevations of two or three thousand feet above the sea on northern slopes and in granite soil. In the planted forests and in the temple gardens of Nikkō the Hi-no-ki often attains the height of a hundred feet, with a tall straight trunk three feet in diameter near the ground and free of branches for fifty or sixty feet, a narrow round-topped head, and pendulous branchlets. The wood is light, strong, tough, and very durable in contact with the soil, straight-grained, free from knots and resin, pleasantly fragrant, and white, straw-colored, or pink, with a lustrous surface. The palaces of the Mikado in Kyōto were made from the wood of this tree, and the roof was covered with strips of its bark; it serves for the frames of Buddhist temples and the interior finish of the most expensive houses, and is considered the best wood to lacquer; during festivals food and drink are offered to the gods on lacquered tables made of Hi-no-ki wood, and from a table of Hi-no-ki the victim of Harikari received the fatal dagger. (See Dupont, *Essences Forestières du Japon*, 18. — Rein, *Industries of Japan*, 233. — Sargent, *Forest Fl. Jap.* 73.)

Introduced into the eastern United States in 1862, *Cupressus obtusa* is hardy as far north as Halifax on the coast of Nova Scotia, although, like many other Japanese trees, it suffers in the New England and Middle States from summer droughts, and does not promise to attain a large size.

In Japan *Cupressus obtusa* is a favorite subject for dwarfing, and is often cut into eccentric shapes. Many abnormal varieties or juvenile forms have long been cultivated, and have been introduced into American and European gardens. The most distinct of these abnormal forms are *Retinospora lycopodioides* (Gordon, *Pinetum*, Suppl. 92 [1862]), in which the stout erect branchlets are densely clothed with bluntly awl-shaped dark green leaves, and *Retinospora filicoides* (Gordon, *Pinetum*, ed. 2, 363 [1875]), with long slender branches clothed with short broad sprays of quadrangular branchlets.

For other garden varieties of *Cupressus obtusa*, see Carrière, *Traité Conif.* ed. 2, 135. — *Gard. Chron.* n. ser. v. 235. — Veitch, *Man. Conif.* 242. — Beissner, *l. c.* 93.

[4] K. Koch, *Dendr. l. c.* 170 (1873). — Masters, *l. c.* 207.

Retinospora pisifera, Siebold & Zuccarini, *l. c.* 39, t. 122 (1842?).

Chamæcyparis pisifera, Endlicher, *l. c.* 64 (1847). — Miquel, *l. c.* — Parlatore, *l. c.* 467. — Franchet & Savatier, *l. c.* 470. — Beissner, *l. c.* 83. — Hansen, *l. c.* 281.

Thuya pisifera, Masters, *Jour. Linn. Soc.* xviii. 489 (*Conifers of Japan*) (1881).

pressus torulosa,[1] and the *Cupressus sempervirens*[2] of southeastern Europe and southwestern Asia.

Cupressus pisifera, the Sawara of the Japanese, is planted in forests, and in temple grounds with *Cupressus obtusa*, from which it can be distinguished by its smaller fruit and by its narrower and more ragged crown of looser and more upright branches. The wood is redder, with a coarse grain, and is less valuable than that of the Hi-no-ki, although in Japan the two species are planted in about equal numbers (Sargent, *Forest Fl. Jap.* 73). In the eastern United States, where it is rather hardier than *Cupressus obtusa*, it grows more rapidly, and promises to attain a larger size, but is less desirable as an ornamental tree.

The most remarkable of the numerous abnormal forms of this tree cultivated in gardens is one on which the leaves are all short and acicular and disposed in decussate pairs, and are pale blue-green and spreading or slightly bent toward the branchlets. It is a low broad bushy tree or dense shrub with large divided and forked branches, and is : —

Cupressus pisifera, var. α *squarrosa*, Masters, *Jour. R. Hort. Soc.* xiv. 207 (1892).

Retinospora squarrosa, Siebold & Zuccarini, *Fl. Jap.* ii. 40, t. 123 (1842 ?). — Gordon, *Pinetum*, ed. 2, 371.

Chamæcyparis squarrosa, Endlicher, *Syn. Conif.* 65 (1847). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 466. — Franchet & Savatier, *Enum. Pl. Jap.* i. 471.

Cupressus squarrosa, K. Koch, *Dendr.* ii. pt. ii. 171 (1873).

Thuya pisifera, var. *squarrosa*, Masters, *Jour. Linn. Soc.* xviii. 490 (*Conifers of Japan*) (1881).

Chamæcyparis pisifera squarrosa, Beissner, *Handb. Nadelh.* 85 (1891).

Almost as remarkable is a form with long slender pendulous thread-like branchlets clothed with subulate acute dark green leaves distributed in remote alternate pairs. This is : —

Cupressus pisifera, var. c *filifera*, Masters, *Jour. R. Hort. Soc. l. c.* (1892).

Retinospora filifera, Gordon, *l. c.* 365 (1875). — Syme, *Gard. Chron.* n. ser. v. 237, f. 43. — Veitch, *Man. Conif.* 243.

Thuya pisifera, var. *filifera*, Masters, *Jour. Linn. Soc. l. c.* 491 (1881).

Chamæcyparis pisifera filifera, Beissner, *l. c.* 90, f. 23 (1891).

Other forms of *Cupressus pisifera* are distinguished by their yellow or silvery leaves, by their dwarf and compact habit, and by their more slender or stouter branches ; but the parentage of all these abnormal forms of the Japanese Retinosporas is sooner or later declared by the appearance of occasional branches covered with normal leaves. (For varieties of *Cupressus pisifera*, see Carrière, *Traité Conif.* ed. 2, 137. — Gordon, *l. c.* 362. — Veitch, *l. c.* 242. — Beissner, *l. c.* 87.)

[1] D. Don, *Prodr. Fl. Nepal.* 55 (1825). — Lambert, *Pinus*, ii. 18. — Loudon, *Arb. Brit.* iv. 2478, f. 2329–2331. — Forbes, *Pinetum Woburn.* 189. — Spach, *Hist. Vég.* xi. 329. — *Flore des Serres*, vii. 192, f. 236. — Endlicher, *l. c.* 57. — Griffith, *Icon. Pl. Asiat.* iv. t. 372. — Carrière, *Traité Conif.* 117. — Gordon, *Pinetum*, 69. — Henkel & Hochstetter, *Syn. Nadelh.* 233. — Parlatore, *l. c.* 469. — Hooker f. *Fl. Brit. Ind.* v. 645. — Masters, *Jour. R. Hort. Soc.* xvii. 11 (*The Cedar of Goa*).

Cupressus Tournefortii, Tenore, *Mem. Soc. Ital. Sci. Modena*, xxv. pt. ii. 194, t. 1, 2 (excl. syn.) (1855).

Cupressus torulosa inhabits dry slopes on the western Himalayas from Nepal to Chamba at elevations of from 5,500 to 8,000 feet, and is widely distributed, although less common than many of the other Himalayan Conifers. It is usually seventy or eighty feet tall, with a trunk two or three feet in diameter, but occasionally attains a height of one hundred and fifty feet, with a trunk five feet through ; its whorls of horizontal branches, pendulous at the extremities, form a broad pyramidal crown, and its thin bark separates into long narrow scales which are often spirally twisted around the stem. The wood is soft and straight-grained but not strong ; it is nearly white tinged with red or yellow, and is occasionally used in building ; matches are made from it, and it is burned as incense. (See Madden, *Proc. Agric. and Hort. Soc. India*, iv. pt. ii. 129 [*Himalayan Coniferæ*]. — Brandis, *Forest Fl. Brit. Ind.* 533. — Gamble, *Man. Indian Timbers*, 410. — Balfour, *Cyclopædia of India*, ed. 3, i. 857.)

[2] Linnæus, *Spec.* 1002 (1753). — Miller, *Dict.* ed. 8, No. 1. — Scopoli, *Fl. Carn.* ed. 2, ii. 249. — Gærtner, *Fruct.* ii. 64, t. 91. — Schkuhr, *Handb.* iii. 286, t. 310. — *Nouveau Duhamel*, iii. 2, t. 1. — Willdenow, *Spec.* iv. pt. i. 511. — Poiret, *Lam. Dict. Ill.* iii. 369, t. 787. — Watson, *Dendr. Brit.* ii. 155, t. 155. — Richard, *Comm. Bot. Conif.* t. 9. — Schouw, *Ann. Sci. Nat.* sér. 3, iii. 241 (*Conifères d'Italie*). — Reichenbach, *Icon. Fl. German.* xi. 5, t. 534. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 20. — Parlatore, *Fl. Ital.* iv. 71 ; *De Candolle Prodr. l. c.* 468. — Boissier, *Fl. Orient.* v. 705. — Hooker f. *l. c.* 645. — Masters, *l. c.*

Cupressus sempervirens, α, Lamarck, *Dict.* ii. 241 (1786).

Cupressus lugubris, Salisbury, *Prodr.* 397 (1796).

Cupressus pyramidalis, Targioni-Tozzetti, *Obs. Bot.* iii. — v. 73 (1810). — Savi, *Tratt. Alb. Tosc.* ed. 2, ii. 64.

Cupressus fastigiata, De Candolle, *Lamarck Fl. Franç.* ed. 3, v. 536 (1815).

Cupressus conoidea, Spadoni, *Xilolog.* i. 189 (1826). — Carrière, *l. c.* 128.

Cupressus sempervirens stricta, Loudon, *l. c.* iv. 2465, f. 2320, 2326, t. (1838).

Cupressus Whitleyana, Carrière, *l. c.* 128 (1855).

Cupressus umbilicata, Parlatore, *Ind. Sem. Hort. Firenze*, 22 (1860) ; *Ann. Sci. Nat.* sér. 4, xiii. 378.

Cupressus sempervirens, ε *Indica*, Parlatore, *De Candolle Prodr. l. c.* 469 (1868).

Cupressus sempervirens, γ *umbilicata*, Parlatore, *l. c.* (1868).

Cupressus sempervirens, α *fastigiata*, Beissner, *l. c.* 102 (1891).

Cupressus sempervirens, which often grows to a great age, is a tree with erect branches pressed against the trunk and forming a narrow compact cylindrical head, and occasionally attains the height of one hundred feet, but is rarely more than seventy or eighty feet tall. Unknown in a wild state, it has been cultivated since very early times, and was carried from Greece to Italy by the Romans. The wood is fragrant, light red-brown in color, and close-grained and very durable, although not hard or strong ; mummy cases are believed to have been made of it in Egypt, and it is said to have furnished the material from which the doors of the temple of Diana at Ephesus and the statue of Jupiter in the Capitol at Rome were made. The Romans used posts and stakes of Cupressus wood for many rural purposes, and in the countries of southeastern Europe it is now made into chests to protect woolens from the attacks of insects.

Among the ancients the evergreen foliage of the Cypress and the fact that it would immediately rise again to an upright position if bent down by the wind or by manual force, ranked it among the symbols of immortality ; it was also regarded as an emblem of mortality and bereavement because, when it was cut down, its stump threw out no fresh shoots. In mediæval Persia the pyramidal outline of the Cypress was thought to resemble a flame, and

Cupressus sempervirens and *Cupressus funebris*[1] have long been used to decorate gardens and burial-places, and *Cupressus Lusitanica*[2] and several of the American species are often planted in parks.

In North America Cupressus is not seriously injured by insect enemies[3] or subject to destructive fungal diseases.[4]

it was planted near the temples of the fire-worshipers. The people of the Levant still plant Cypress-trees in their burial-grounds, and the Turks place one at either end of the grave. For centuries it has been cultivated in gardens in Afghanistan, Cashmere, and the other states of northwestern India. The Romans used it for garden decoration, cutting it into fantastic shapes ; it is still one of the chief ornaments of the formal gardens of southern Europe, and its dark slender forms, rising singly or in groups or rows from the court-yards of houses, give charm and individuality to the towns of southern and southeastern Europe and southwestern Asia. (See Loudon, *Arb. Brit.* iv. 2464. — Brandis, *Forest Fl. Brit. Ind.* 533. — *Garden and Forest*, ii. 458.)

Botanists are now nearly unanimous in believing the pyramidal Cypress to be a form of the Cypress of the mountainous districts of the eastern Mediterranean Basin where it is distributed from the island of Crete to northern Persia. This is : —

Cupressus sempervirens horizontalis, Loudon, *l. c.* 2465 (1838). — Gordon, *Pinetum*, 68. — Parlatore, *Fl. Ital.* iv. 72 ; *De Candolle Prodr.* xvi. pt. ii. 468. — Beissner, *Handb. Nadelh.* 102.

Cupressus sempervirens, β, Linnæus, *Spec.* 1003 (1753). — Lamarck, *Dict.* ii. 242. — Aiton, *Hort. Kew.* iii. 372. — Spach, *Hist. Vég.* xi. 326.

Cupressus horizontalis, Miller, *Dict.* ed. 8, No. 2 (1768). — *Nouveau Duhamel*, iii. 6. — Willdenow, *Spec.* iv. pt. i. 511. — Endlicher, *Syn. Conif.* 56. — Reichenbach, *Icon. Fl. German.* xi. 5, t. 534. — Carrière, *Traité Conif.* 115. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 21.

Cupressus elongata, Salisbury, *Prodr.* 397 (1796).

Cupressus patula, Spadoni, *Xilolog.* i. 193 (1826).

Cupressus horizontalis, β *pendula*, Endlicher, *l. c.* (1847).

Cupressus globulifera, Parlatore, *Ann. Sci. Nat.* sér. 4, xiii. 377 (1860).

Cupressus sphærocarpa, Parlatore, *l. c.* 378 (1860).

Cupressus sempervirens, γ *sphærocarpa*, Parlatore, *De Candolle Prodr. l. c.* 468 (1868).

Cupressus sempervirens, δ *globulifera*, Parlatore, *l. c.* 469 (1868).

[1] "These monuments of departed greatness are surrounded by trees, such as different species of Cypress, whose deep and melancholy hue seems to have pointed them everywhere out, as well suited for scenes of woe : the Church-yard Yew did not, however, grow there, nor was it observed in any part of China : but a species of weeping thuya, or lignum vitæ, with long and pendent branches, unknown in Europe, overhung many of the graves." (Staunton, *Embassy to China*, ii. 445, t. 41 [1797].) This is the first reference in western literature to this tree, which is : —

Cupressus funebris, Endlicher, *l. c.* 58 (1847). — Carrière, *l. c.* 120. — Planchon, *Fl. des Serres*, vi. 90, t. — *Gard. Chron.* 1850, 439, f. 31–33. — Gordon, *l. c.* 60. — Henkel & Hochstetter, *Syn. Nadelh.* 236. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 471. — Hooker f. *Fl. Brit. Ind.* v. 646.

Cupressus pendula, Lambert, *Pinus*, ii. 115, t. 50 (not Thunberg nor L'Heritier [1824]).

Cupressus funebris is a tree, sometimes eighty feet in height, with a tall erect cylindrical trunk, and long slender pendulous branches which form a broad symmetrical head. Light glaucous acicular leaves clothe the young plants, and are followed by scale-like closely appressed yellow-green leaves ; erect in habit while young, its horizontal branches lengthen and become pendulous with age and develop long slender branchlets which descend toward the ground. *Cupressus funebris* appears to be indigenous in western China, and is frequently used in the Celestial Empire to mark graves and to decorate gardens and temple grounds ; and in Nepaul, Sikkim, and Bhotan, at elevations of from four to eight thousand feet, it is planted near Buddhist temples. (See Hooker, f. *Himalayan Journals*, i. 314, f.) It was introduced into England in 1849 by Robert Fortune, who found it in a garden not far from Shanghai, and afterward also farther west, "frequently in clumps on the sides of the hills, where it has a most striking and beautiful effect on the Chinese landscape" (Fortune, *Gard. Chron.* 1850, 228). In the United States and in Europe *Cupressus funebris* has not yet developed the beauty which it displays in its native country (Veitch, *Man. Conif.* 229).

[2] Miller, *Dict.* ed. 8, No. 3 (1768). — Willdenow, *Spec.* iv. pt. i. 511. — Loudon, *l. c.* 2477, f. 2328. — Tenore, *Mem. Soc. Ital. Sci. Modena*, xxv. pt. ii. 189. — Carrière, *l. c.* 119. — Gordon, *l. c.* 63.

Cupressus pendula, L'Héritier, *Stirp. Nov.* 15, t. 8 (not Thunberg nor Lamarck) (1784).

Cupressus glauca, Lamarck, *Dict.* ii. 243 (1786). — Brotero, *Fl. Lusitan.* i. 216. — Spach, *Hist. Vég.* xi. 328. — Endlicher, *l. c.* 58. — Henkel & Hochstetter, *l. c.* 235. — Parlatore, *l. c.* 470.

Cupressus Lusitanica, usually called the Cedar of Goa, is a tree sixty or seventy feet tall, with spreading flexuose branches and pendulous branchlets clothed with glaucous leaves ; it has been cultivated in Portugal, where it has been naturalized for more than two hundred and fifty years, and near Coimbra in the forest of Bussaco it now forms an ancient grove in which more than five thousand trees are said to grow (Gomes, *Jorn. Hort. Prat.* ii. 64. — Magalhães, *Relatorio da Administração geral das Mattas do Reino*, 1872–73, 141. — Daveau, *Rev. Hort.* 1884, 184) ; in England it has been cultivated at least since 1680. *Cupressus Lusitanica* is not believed by Portuguese botanists to be a native of that country ; and it is probably, as its popular name indicates, a native of India, where it is still cultivated in the gardens of the western Ghats. Several Indian botanists believe it to be a form of *Cupressus sempervirens* or of *Cupressus torulosa* (see Dalzell & Gibson, *Bomb. Fl.* Suppl. 83. — Hooker f. *l. c.* 645), but Brandis (*l. c.* 534) considers that the specific distinctions between these species invite further investigation, and Masters, who has written the history of the Cedar of Goa, reaches the same conclusion. (See *Jour. R. Hort. Soc.* xvii. 1 [*The Cedar of Goa*].)

[3] Few species of insects are known to affect Cupressus in North America, although these trees and their insect enemies have received little attention from entomologists. A bark beetle, *Phlœosinus cristatus*, Leconte, is said to be destructive to hedges and windbreaks of *Cupressus macrocarpa* in Contra Costa County, California (*Insect Life*, v. 262) ; and a twig borer, *Argyresthia cupressella*, Walsingham, is described as causing the twigs of cultivated Cypress-trees in the neighborhood of Los Angeles, California, to turn brown and die in the spring (*Insect Life*, iii. 116). Small cone-like swellings are found on the tips of twigs of *Cupressus macrocarpa* at Monterey, California, but the insects which cause them have not been studied.

[4] Little is known of the species of fungi which grow on the

Cupressus may be raised from seeds, which germinate the first season, and by cuttings made from leading branchlets of the year.[1]

Cupressus, the classical name of the Cypress-tree, was adopted by Linnæus from Tournefort[2] and other pre-Linnæan botanists.

Cypress-trees of Pacific North America, although half a dozen are reported on the leaves and branches of *Cupressus macrocarpa*, including two species of Pestalozzia, which, however, are not confined to Cupressus. *Cupressus thyoides* of the Atlantic coast region is attacked, however, by two very characteristic Rust fungi, *Gymnosporangium biseptatum*, Ellis, and *Gymnosporangium Ellisii*, Farlow. The former causes oval or nodular swellings on the branchlets, attacking even the larger branches and sometimes the main trunk. These tumor-like bodies are often of a large size, so that a tree affected by this fungus can be recognized from a considerable distance. Its cluster-cup, *Ræstelia Botryapites*, Schweinitz, is found on the leaves of *Amelanchier Canadensis*, Medicus. *Gymnosporangium Ellisii* causes a fasciation of the smaller branches, which then resemble more or less fan-shaped brooms. The external portion of the fungus is smaller and less gelatinous than in any other species of this genus; its cluster-cup stage is unknown. A few small fungi also attack the leaves and twigs of these trees, including two species of Hendersonia and Pestalozzia; and *Pitya Cupressi*, Saccardo, appears on the leaves with small flat cups or disks of an agreeable orange-color. A rotting of railway-ties made of the wood of this species is reported to be due to the growth of *Agaricus Campanella*, Batsch, a small toad-stool common on the trunks of several trees in Europe and America.

[1] Daveau, *Rev. Hort.* 1887, 88.

[2] *Inst.* 587, t. 358.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

EUCUPRESSUS. Cones large, maturing the second season; seeds numerous; branchlets quadrangular; leaves denticulate.

Leaves obscurely glandular.

Branchlets stout; leaves dark green . . . . . 1. C. MACROCARPA.

Branchlets stout; leaves glaucous . . . . . 2. C. ARIZONICA.

Branchlets slender; leaves dark green . . . . . 3. C. GOVENIANA.

Leaves conspicuously glandular.

Branchlets slender; leaves dark green, often slightly glaucous . . . . . 4. C. MACNABIANA.

CHAMÆCYPARIS. Cones small, maturing the first season; seeds 1 to 4; branchlets flattened in one horizontal plane; leaves entire.

Bark thin, divided into flat ridges.

Branchlets slender, compressed, their leaves often conspicuously glandular . . . . 5. C. THYOIDES.

Branchlets stout, slightly flattened or subterete; leaves usually eglandular . . . . 6. C. NOOTKATENSIS.

Bark thick, divided into broad rounded ridges.

Branchlets slender, compressed; leaves conspicuously glandular . . . . . 7. C. LAWSONIANA.

CUPRESSUS MACROCARPA.

Monterey Cypress.

FRUIT large. Branchlets stout. Leaves dark green, obscurely glandular.

Cupressus macrocarpa, Gordon, *Jour. Hort. Soc. Lond.* iv. 296, f. (1849); *Pinetum*, 65. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 206. — Knight, *Syn. Conif.* 20. — Bentham, *Pl. Hartweg.* 337. — Torrey, *Bot. Mex. Bound. Surv.* 211. — Henkel & Hochstetter, *Syn. Nadelh.* 239. — (Nelson) Senilis, *Pinaceæ*, 73. — Hoopes, *Evergreens*, 353. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 473. — K. Koch, *Dendr.* ii. pt. ii. 148. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 113. — Veitch, *Man. Conif.* 234. — Lawson, *Pinetum Brit.* ii. 195, t. 32. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 179. — Lemmon, *Rep. California State Board Forestry*, iii. 180, t. 25, 26 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 76. — Mayr, *Wald. Nordam.* 271, f. 8. — Beissner, *Handb. Nadelh.* 103. — Masters, *Jour. R. Hort. Soc.* xiv. 206; *Jour. Linn. Soc.* xxxi. 342 (excl. var. *Guadeloupensis* and var. *Farallonensis*). — Hansen, *Jour. R. Hort. Soc.* xiv. 286 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 50.

Cupressus macrocarpa, var. **fastigiata**, Knight, *Syn. Conif.* 20 (1850). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 473. — Veitch, *Man. Conif.* 234.

Cupressus torulosa, Lindley & Paxton, *Fl. Gard.* i. 167, f. 105 (not D. Don) (1851); *Fl. des Serres*, vii. 192, f. — *The Garden*, xxvii. 39, f.

Cupressus Lambertiana, Carrière, *Traité Conif.* 124 (1855); *Rev. Hort.* 1855, 233.

Cupressus Lambertiana, var. **fastigiata**, Carrière, *Traité Conif.* 124 (1855).

Cupressus Hartwegii, Carrière, *Rev. Hort.* 1855, 233: *Traité Conif.* ed. 2, 168.

Cupressus Hartwegii, var. **fastigiata**, Carrière, *Traité Conif.* ed. 2, 169 (1867).

Cupressus macrocarpa, var. **Lambertiana**, Masters, *Jour. Linn. Soc.* xxxi. 343 (1896).

A tree, often sixty or seventy feet in height, with a short trunk two or three, or exceptionally five or six feet in diameter; while it is young the branches are slender and erect, forming a narrow or broad bushy pyramidal head, and when uncrowded by other trees they become stout and spreading in old age, and form a broad flat-topped head.[1] The bark of the trunk is from three quarters of an inch to an inch in thickness, and irregularly divided into broad flat connected ridges, which separate freely into narrow elongated thick persistent scales; on young stems and on the upper branches it is dark red-brown, but on old and storm-worn trees becomes at last almost white. The branchlets are stout, and when the leaves fall, at the end of three or four years, are covered with thin light or dark reddish brown bark, which separates sparingly into small papery scales. The leaves are broadly ovate, closely appressed or slightly spreading at the acute apex, thickened on the back, which is obscurely glandular-pitted, and frequently marked with two longitudinal furrows, about an eighth of an inch long, and dark green; those on young plants are spreading and acicular, prominently ridged below, and from one quarter to one half of an inch in length. The flowers are yellow, and open late in February or early in March. The staminate flowers are oblong, quadrangular, and an eighth of an inch long, with six or eight decussately opposite stamens, their broadly ovate peltate connectives, which are slightly erose on the margins, bearing four or five dark orange-colored pollen-sacs. The pistillate flowers are oblong and about an eighth of an inch in length, with spreading acuminate scales. The fruit, which ripens in the second season, and is clustered, is raised on a stout peduncle from a quarter to a third of an inch in length, and is oblong, from an inch to an inch and a half long, and about two thirds of an inch broad, with four or six pairs of scales, slightly puberulous, especially on the margins, furnished with broadly ovate thickened or occasionally on the upper scales subconical bosses, the scales of the upper and lower pairs being smaller than the others and sterile. About twenty seeds are produced under each fertile scale; they are angled by mutual pressure, light chestnut-brown, and about three sixteenths of an inch long.

[1] Hooker f. *Gard. Chron.* n. ser. xxiii. 176, f. 34. — *Garden and Forest*, vii. 241, f. 7.

Cupressus macrocarpa inhabits the coast of California south of the Bay of Monterey, where it occupies an area about two miles long and two hundred yards wide, extending from Cypress Point southward to the shores of Carmel Bay, and forms a smaller grove on Point Lobos, the southern boundary of the bay. In this restricted region the Monterey Cypress gives a peculiar picturesqueness to one of the most beautiful reaches of coast on the continent. The high bright red granite cliffs perpetually bathed in spray are crowned by solitary, sentinel-like trees, with low flat heads and branches contorted by the gales of the Pacific; just back of the cliffs it forms a grove broken into grass-covered glades bright in early spring with countless flowers, where scattered individuals display the greatest size and beauty attained by this tree; and farther inland it mingles gradually with *Pinus insignis*, which at this point is the principal inhabitant of the forests of the low rolling coast-hills.[1]

The wood of *Cupressus macrocarpa* is heavy, hard, and strong, although rather brittle, very durable in contact with the soil, close-grained, easily worked, and slightly fragrant, with a satiny surface susceptible of receiving a beautiful polish; it is clear bright brown streaked with red and yellow, with thin light yellow sapwood, and contains thin dark-colored conspicuous bands of small summer-cells and numerous hardly distinguishable medullary rays. The specific gravity of the absolutely dry wood is 0.6261, a cubic foot weighing 39.02 pounds.

Although its seeds appear to have reached England in 1838,[2] *Cupressus macrocarpa* was first made known to botanists in 1847 by Karl Theodor Hartweg,[3] who had found it at Cypress Point the previous autumn.[4] It is now the most universally cultivated coniferous tree in the Pacific states, where it has proved hardy from Vancouver's Island to Lower California, and grows with remarkable rapidity; it is one of the chief ornaments of the parks and gardens of central California, and, enduring an annual shortening of the branches, it is often cut into fantastic forms, and is also successfully used in hedges and wind-breaks. *Cupressus macrocarpa* has proved hardy in the southeastern states, where, however, it has not been largely planted, in western and southern Europe, where it grows as rapidly as it does in California, and has already attained a large size,[5] and in temperate South America and Australia. In European nurseries a few abnormal seminal forms have appeared, and are occasionally cultivated.[6]

[1] The vigorous constitution which this tree shows in its ability to withstand long exposure to gales and saline spray on the cliffs of the Pacific Ocean, and in its unusual power to adapt itself to very different climatic conditions, would seem to indicate that it once occupied a much larger area of central California, and has been restricted to the shores of Carmel Bay by the gradual drying of the climate, or by the direct action of fire during comparatively recent times.

[2] Seeds of a Cupressus were given by Mr. Lambert to the Horticultural Society of London in 1838. These produced plants to which the name of *Cupressus Lambertiana* was provisionally given, and which afterwards proved to be Hartweg's *Cupressus macrocarpa*. (See Gordon, *Jour. Hort. Soc. Lond.* iv. 296.)

[3] See ii. 34.

[4] Hartweg, *Jour. Hort. Soc. Lond.* ii. 187.

[5] Fowler, *Gard. Chron.* 1872, 285; n. ser. xx. 603. — *Gard. Chron.* ser. 3, xvi. 658.

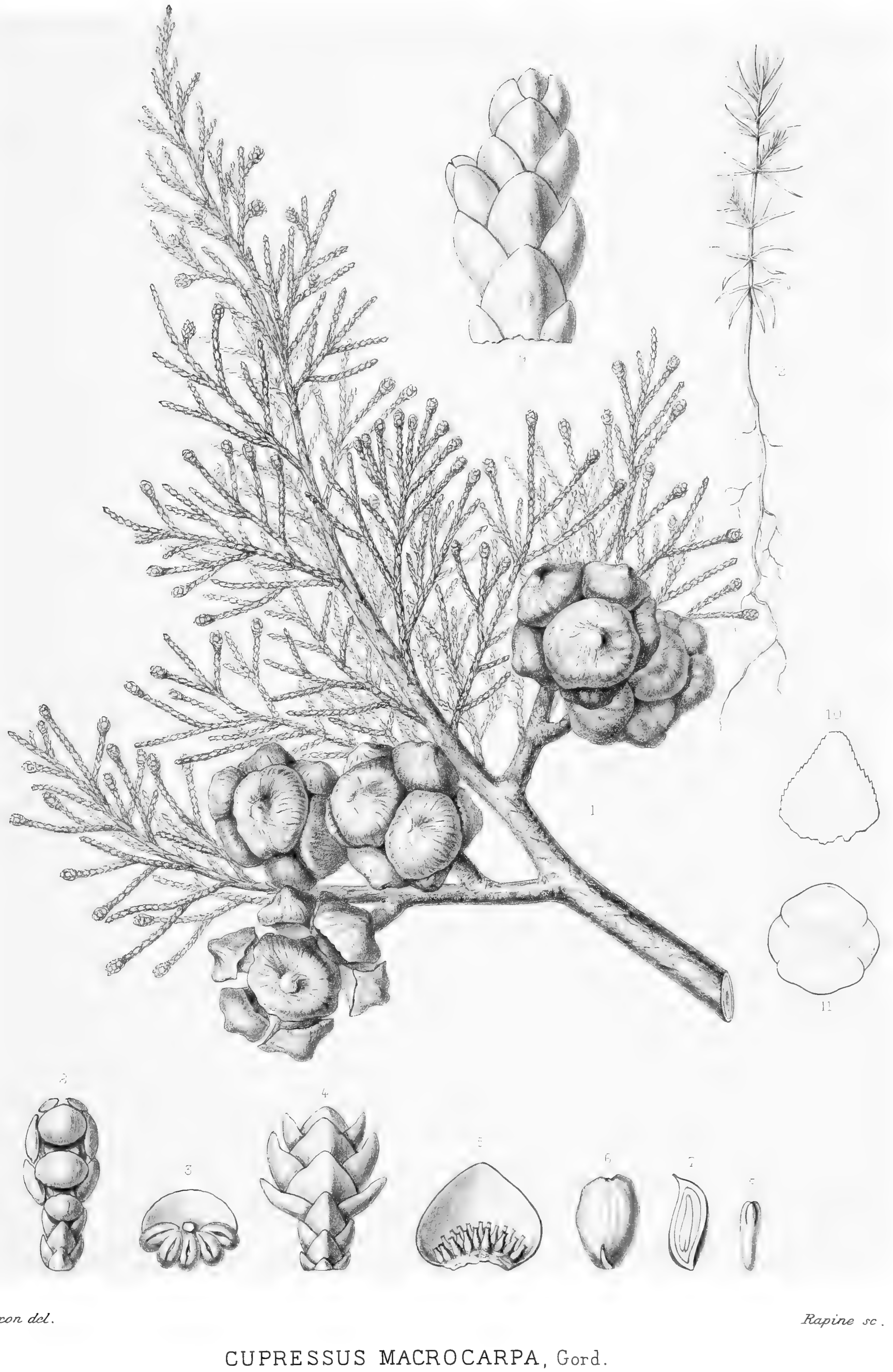
[6] *Cupressus macrocarpa Crippsi* (Gordon, *Pinetum*, ed. 2, 93 [1875]) is distinguished by its compact habit and the silvery whiteness of the young leaves. In *Cupressus macrocarpa flagelliformis* (Gordon, *l. c.* [1875]) the branches are long and slightly pendulous, with elongated branchlets clothed with light glaucous green foliage. For other varieties of *Cupressus macrocarpa*, see Carrière, *Traité Conif.* ed. 2, 167; *Rev. Hort.* 1870, 191, f. 37.

In European gardens *Cupressus macrocarpa* is occasionally cultivated as *Cupressus Reinwardtii*.

EXPLANATION OF THE PLATE.

PLATE DXXV. CUPRESSUS MACROCARPA.

1. A flowering and fruiting branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A pistillate flower, enlarged.
5. A scale of a pistillate flower with its ovules, front view, enlarged.
6. A seed, enlarged.
7. Vertical section of a seed, enlarged.
8. An embryo, enlarged.
9. End of a branchlet, enlarged.
10. A leaf, enlarged.
11. Cross section of a branchlet, enlarged.
12. A seedling, natural size.



C.E. Faxon del. *Rapine sc.*

CUPRESSUS MACROCARPA, Gord.

A. Riocreux direx. *Imp. J. Taneur, Paris.*

CUPRESSUS ARIZONICA.

Cypress.

FRUIT large. Branchlets stout. Leaves glaucous, usually eglandular.

Cupressus Arizonica, Greene, *Bull. Torrey Bot. Club*, ix. 64 (1882). — Rusby, *Bull. Torrey Bot. Club*, ix. 79. — Watson, *Proc. Am. Acad.* xviii. 157. — Lemmon, *Rep. California State Board Forestry*, iii. 179 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 75. — Masters, *Jour. R. Hort. Soc.* xiv. 204.

Cupressus Guadalupensis, Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 180 (not Watson) (1884).

Cupressus Arizonica var. **bonita**, Lemmon, *West-American Cone-Bearers*, 76 (1895).

Cupressus Benthami, var. **Arizonica**, Masters, *Kew Hand-List of Coniferæ*, 37 (1896); *Jour. Linn. Soc.* xxxi. 340, f. 14, 17.

A tree, usually thirty or forty, but occasionally seventy feet in height, with a trunk from two to four feet in diameter, and horizontal branches forming a narrow pyramidal or occasionally a broad flat head. The bark on old trunks is thin and dark red-brown, and separates freely into long shreds one or two inches in width, which often remain hanging upon it for years; on young trunks and on the branches it breaks into large irregular thin scales, which, in falling, disclose the bright red inner bark. The branchlets are stout, and after the leaves have fallen are covered with smooth close thin light red-brown bark, more or less covered with a glaucous bloom. The leaves are ovate, acute, thickened, carinate and eglandular or occasionally obscurely glandular-pitted on the back, pale glaucous green, closely appressed or often slightly spreading, and about an eighth of an inch in length; dying usually during the second season, they become light red-brown and glaucous, and remain on the branches for two or three years longer. The staminate flowers are oblong, obtuse, nearly a quarter of an inch in length, and composed of six or eight stamens, with broadly ovate acute yellow connectives slightly erose on the margins. The pistillate flowers are unknown. The fruit is subglobose, slightly puberulous, about an inch in diameter, dark red-brown, covered with a thick glaucous bloom, and raised on a stout peduncle from one quarter to one third of an inch in length, with six, or occasionally eight scales, furnished with stout cylindrical pointed often incurved prominent bosses. The seeds vary in shape from oblong to nearly triangular, and from one sixteenth to nearly one eighth of an inch in length, and are dark red-brown, with thin narrow wings.

Cupressus Arizonica inhabits the mountains of central, eastern, and southern Arizona, often constituting, usually on northern slopes, almost pure forests of considerable extent, at elevations of from five to eight thousand feet above the sea, and also the mountains of northern Sonora and Chihuahua. Local in its distribution in Arizona, it forms a grove of several thousand trees at the natural bridge over Pine Creek, a tributary of the Verde River near Payson, in central Arizona;[1] it grows on the Santa Rita, Santa Catalina, and Chiracahua Mountains in the southern part of the territory, and on the San Francisco Mountains in the extreme eastern part, where it was discovered in the neighborhood of the town of Clifton on September 1, 1880, by Professor Edward L. Greene;[2] and on the mountain ranges north of Mt. Graham it is common, and forms extensive forests.

The wood of *Cupressus Arizonica* is light, soft, close-grained, and easily worked. It is gray, often faintly streaked with yellow, with thick light yellow sapwood, and contains broad conspicuous bands of small summer-cells and numerous obscure medullary rays. The specific gravity of the absolutely dry wood is 0.4843, a cubic foot weighing 30.18 pounds.

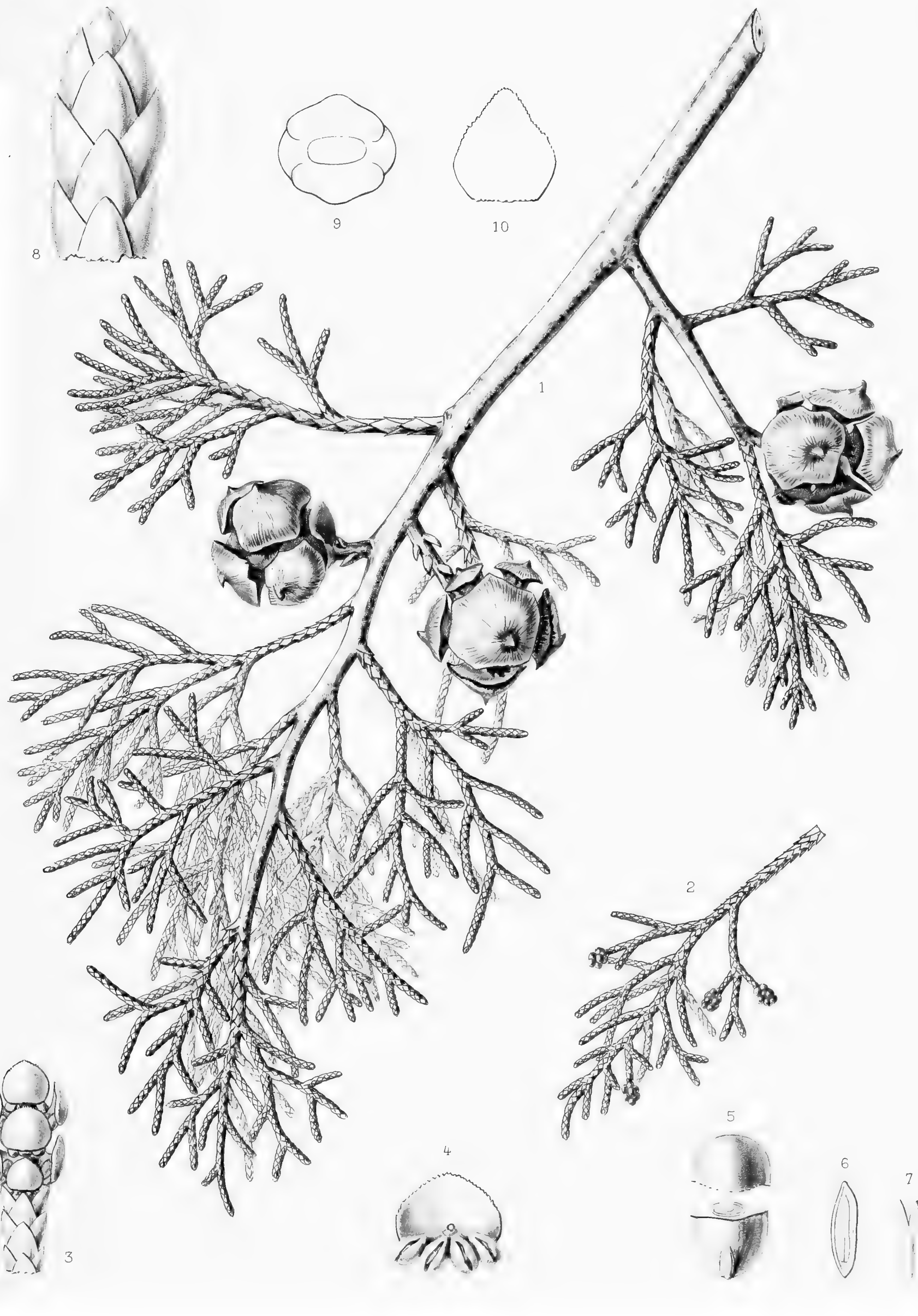
Cupressus Arizonica was introduced into European gardens in 1882 through the agency of the Arnold Arboretum, and has proved hardy in England.[3]

[1] Toumey, *Garden and Forest*, viii. 22. [2] See viii. 84. [3] Masters, *Gard. Chron.* ser. 3, x. 364.

EXPLANATION OF THE PLATE.

PLATE DXXVI. CUPRESSUS ARIZONICA.

1. A fruiting branch, natural size.
2. A branch with staminate flowers, natural size.
3. A staminate flower, enlarged.
4. A stamen, front view, enlarged.
5. A seed divided transversely, enlarged.
6. Vertical section of a seed, enlarged.
7. An embryo, enlarged.
8. The end of a branchlet, enlarged.
9. Cross section of a branchlet, enlarged.
10. A leaf, enlarged.



C.E.Faxon del. Himely sc.

CUPRESSUS ARIZONICA, Greene.

A.Riocreux direx.t. Imp. J.Taneur, Paris.

CUPRESSUS GOVENIANA.

Cypress.

FRUIT large or small. Branchlets slender. Leaves dark green, eglandular or obscurely glandular.

Cupressus Goveniana, Gordon, *Jour. Hort. Soc. Lond.* iv. 295, f. (1849); *Pinetum*, 60. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 206. — Carrière, *Traité Conif.* 125. — Torrey, *Bot. Mex. Bound. Surv.* 211. — Bentham, *Pl. Hartweg.* 337. — Henkel & Hochstetter, *Syn. Nadelh.* 240. — Hoopes, *Evergreens*, 352. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 472. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 114. — Veitch, *Man. Conif.* 230. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 179. — Masters, *Jour. R. Hort. Soc.* xiv. 205; *Jour. Linn. Soc.* xxxi. 346, f. 21, 22. — Hansen, *Jour. R. Hort. Soc.* xiv. 284 (*Pinetum Danicum*). — Lemmon, *West-American Cone-Bearers*, 76.

Cupressus Californica, Carrière, *Traité Conif.* 127 (1855).

Cupressus Californica gracilis, (Nelson) Senilis, *Pinaceæ*, 70 (in part) (1866).

Cupressus cornuta, Carrière, *Rev. Hort.* 1866, 250, f.

Cupressus macrocarpa, ? var. **Farallonensis**, Masters, *Jour. Linn. Soc.* xxxi. 344 (1896).

A tree, occasionally fifty feet tall, with a short trunk two feet in diameter, and slender erect or spreading branches which form a handsome open head; usually much smaller, often shrubby in habit, and frequently producing fruit when only twelve or eighteen inches in height. The bark of the trunk varies from one quarter to one half of an inch in thickness, and is dark brown tinged with red, and divided irregularly into narrow flat connected ridges which separate into thin persistent oblong scales displaying, when they fall, the bright red-brown inner bark. The branchlets are slender and covered with close thin smooth bark orange-colored at first, but soon turning bright reddish brown, and often at the end of two or three years becoming purplish in color, and finally a dark brown more or less tinged with gray. The leaves, which on vigorous young shoots are remote by the lengthening of the nodes, are ovate, acute, rounded and obscurely glandular-pitted or eglandular on the back, closely appressed, dark green, and from one sixteenth to one eighth of an inch in length; in dying they turn bright red-brown, and fall at the end of three or four years; those on young plants are acicular, spreading, and from one eighth to one quarter of an inch in length. The flowers are yellow, and appear in early spring. The staminate flowers are four-angled, with thin broadly ovate slightly erose peltate connectives; and the pistillate are usually composed of six or eight acute slightly spreading scales, and are about an eighth of an inch long. The fruit is subglobose or oblong, from half an inch to nearly an inch in length, reddish brown or purple, lustrous, and slightly puberulous, especially along the margins of the scales; these are six or eight in number, with broadly ovate, generally rounded and flattened, or rarely short and conical bosses. The seeds are light brown and lustrous, about one sixth of an inch in length, and flattened or four-angled, about twenty being produced under each fertile scale.

Exceedingly variable in size and habit and in the thickness of its branchlets and the size of its cones, *Cupressus Goveniana*, although nowhere very abundant, is widely distributed through the California coast region, from the plains of Mendocino County to the mountains of San Diego County, frequently ascending the cañons of the mountain ranges of central California to elevations of nearly three thousand feet above the level of the sea, and attaining its largest size near mountain streams, where it is often associated with the Douglas Fir and the Yellow Pine; more abundant at lower elevations, it often covers in Monterey and Mendocino Counties extensive tracts of sandy barrens or rocky slopes extending inland a few miles from the coast, growing as a low bush frequently only a few inches in height.

The wood of *Cupressus Goveniana* is light, soft, not strong, brittle, and close-grained; it is light

brown, with thick nearly white sapwood, and contains broad dark-colored conspicuous bands of small summer-cells and thin obscure medullary rays. The specific gravity of the absolutely dry wood is 0.4689, a cubic foot weighing 29.22 pounds.

Cupressus Goveniana was discovered in 1846 by Karl Theodor Hartweg, by whom it was introduced into English gardens. It has proved hardy in western and southern Europe, where it is frequently cultivated as an ornamental tree,[1] and has attained a large size and produced its fruit. Forms abnormal in habit and in the color of the foliage which have appeared in European nurseries are occasionally cultivated.[2]

The specific name commemorates the services to horticulture of James Robert Gowen.[3]

[1] Fowler, *Gard. Chron.* 1872, 285.

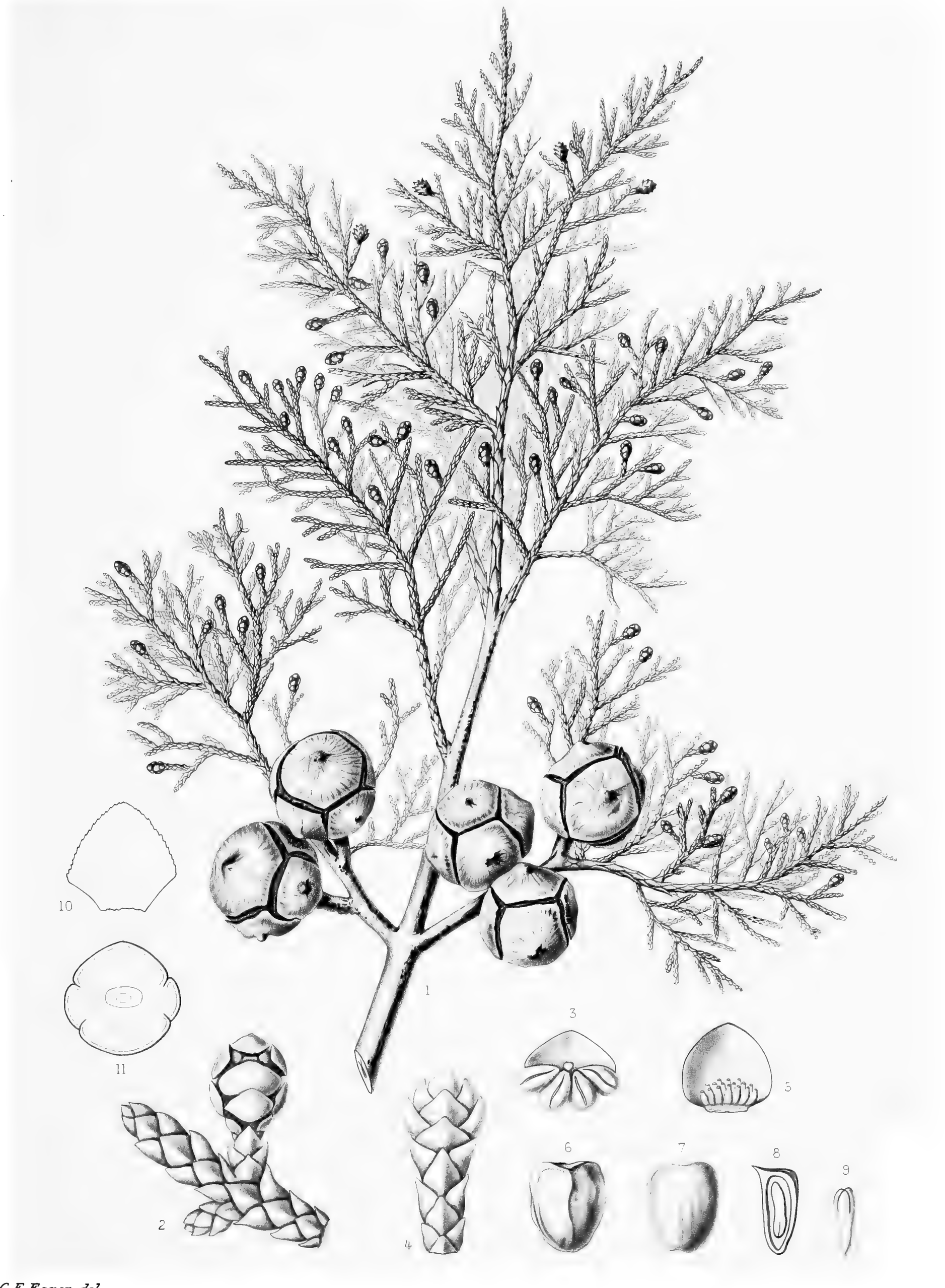
[2] See Carrière, ed. 2, 171.

[3] "Mr. Gowen is a gentleman of independent fortune, much devoted to Science, and well known in the most respectable circles in London; and under whose advice and direction many of the improvements at High Clere had been effected by the late Earl of Caernarvon" (Hooker, *Bot. Mag.* lxv. under t. 3676). Mr. Gowen was a member of the council of the Horticultural Society of London from 1836 to the end of 1856, and also served it as secretary. He was the author of several papers on the hybridization of Amaryllis, published in the Transactions of this Society.

EXPLANATION OF THE PLATE.

PLATE DXXVII. CUPRESSUS GOVENIANA.

1. A flowering and fruiting branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A pistillate flower, enlarged.
5. A scale of a pistillate flower with ovules, front view, enlarged.
6. A seed, enlarged.
7. A seed, enlarged.
8. Vertical section of a seed, enlarged.
9. An embryo, enlarged.
10. A leaf, enlarged.
11. Cross section of a branchlet, enlarged.



C.E. Faxon del.

Lövendal sc.

CUPRESSUS GOVENIANA, Gord.

A. Riocreux direx.t

Imp. J. Taneur, Paris

CUPRESSUS MACNABIANA.

Cypress.

FRUIT large. Branchlets slender. Leaves dark green, often glaucous, conspicuously glandular.

Cupressus Macnabiana, A. Murray, *Edinburgh New Phil. Jour.* n. ser. i. 293, t. 11 (1855). — *Gard. Chron.* 1855, 420. — Gordon, *Pinetum*, 64. — Carrière, *Traité Conif.* ed. 2, 165; *Rev. Hort.* 1870, 155, f. 26. — Hoopes, *Evergreens*, 353. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 473. — K. Koch, *Dendr.* ii. pt. ii. 150. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 114. — Veitch, *Man. Conif.* 233. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 180. — Beissner, *Handb. Nadelh.* 100. — Masters, *Jour. R. Hort. Soc.* xiv. 206; *Jour. Linn. Soc.* xxxi. 347, f. 23, 24. — Hansen, *Jour. R. Hort. Soc.* xiv. 286 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 50. — Lemmon, *West-American Cone-Bearers*, 77.

Cupressus glandulosa, Henkel & Hochstetter, *Syn. Nadelh.* 241 (1865).

Cupressus Californica gracilis (Nelson) Senilis, *Pinaceæ*, 70 (in part) (1866).

Cupressus Nabiana, Masters, *Gard. Chron.* ser. 3, ix. 403, f. 90 (1891).

A bushy tree, rarely thirty feet in height, with a short trunk twelve or fifteen inches in diameter; or more often a shrub with numerous stems from six to twelve feet tall forming a broad open irregular head. The bark of the trunk is thin, dark reddish brown, and broken into broad flat ridges, which form a network of diamond-shaped depressions, and separate on the surface into elongated thin slightly attached long-persistent scales. The branchlets are slender, and are covered with close smooth compact bark, which is bright purplish red after the falling of the leaves, but soon becomes dark brown. The leaves are ovate, acute or rounded at the apex, rounded and conspicuously glandular on the back, closely appressed, or on vigorous young shoots long-pointed and more or less spreading, deep green, and often slightly glaucous, and usually not more than a sixteenth of an inch in length. The flowers open in March and April. The staminate flowers are nearly cylindrical, obtuse, and about a sixteenth of an inch long, with broadly ovate rounded peltate connectives; and the pistillate are subglobose and a sixteenth of an inch long, with broadly ovate scales short-pointed and rounded at the apex. The fruit is oblong, from three quarters of an inch to an inch in length, subsessile or raised on a rather slender peduncle often a quarter of an inch in length, dark reddish brown, more or less covered with a glaucous bloom, and slightly puberulous, especially along the margins of the scales; these are six or rarely eight in number, with prominent bosses, which are thin and recurved on the lower scales, and much thickened, conical and more or less incurved at the apex on the upper scales. The seeds are numerous, dark chestnut-brown, variously flattened by mutual pressure, usually rather less than a sixteenth of an inch long, and furnished with narrow wings.

Cupressus Macnabiana, which is one of the rarest trees of California, is now known to inhabit only a few dry slopes on the hills south and west of Clear Lake in Lake County.[1] At the southern base of Mt. Shasta, where it was discovered by Mr. William Murray in the autumn of 1854, it has not been again seen.

The wood of *Cupressus Macnabiana* is light, soft, very close-grained, and pale brown, with thick nearly white sapwood; it contains narrow dark-colored conspicuous bands of small summer-cells and thin obscure medullary rays. The specific gravity of the absolutely dry wood is 0.5575, a cubic foot weighing 34.74 pounds.[2]

Introduced by its discoverer into English gardens, *Cupressus Macnabiana* is occasionally cultivated in western and southern Europe.

[1] Purdy, *Garden and Forest*, ix. 232.

[2] *Garden and Forest*, iii. 355.

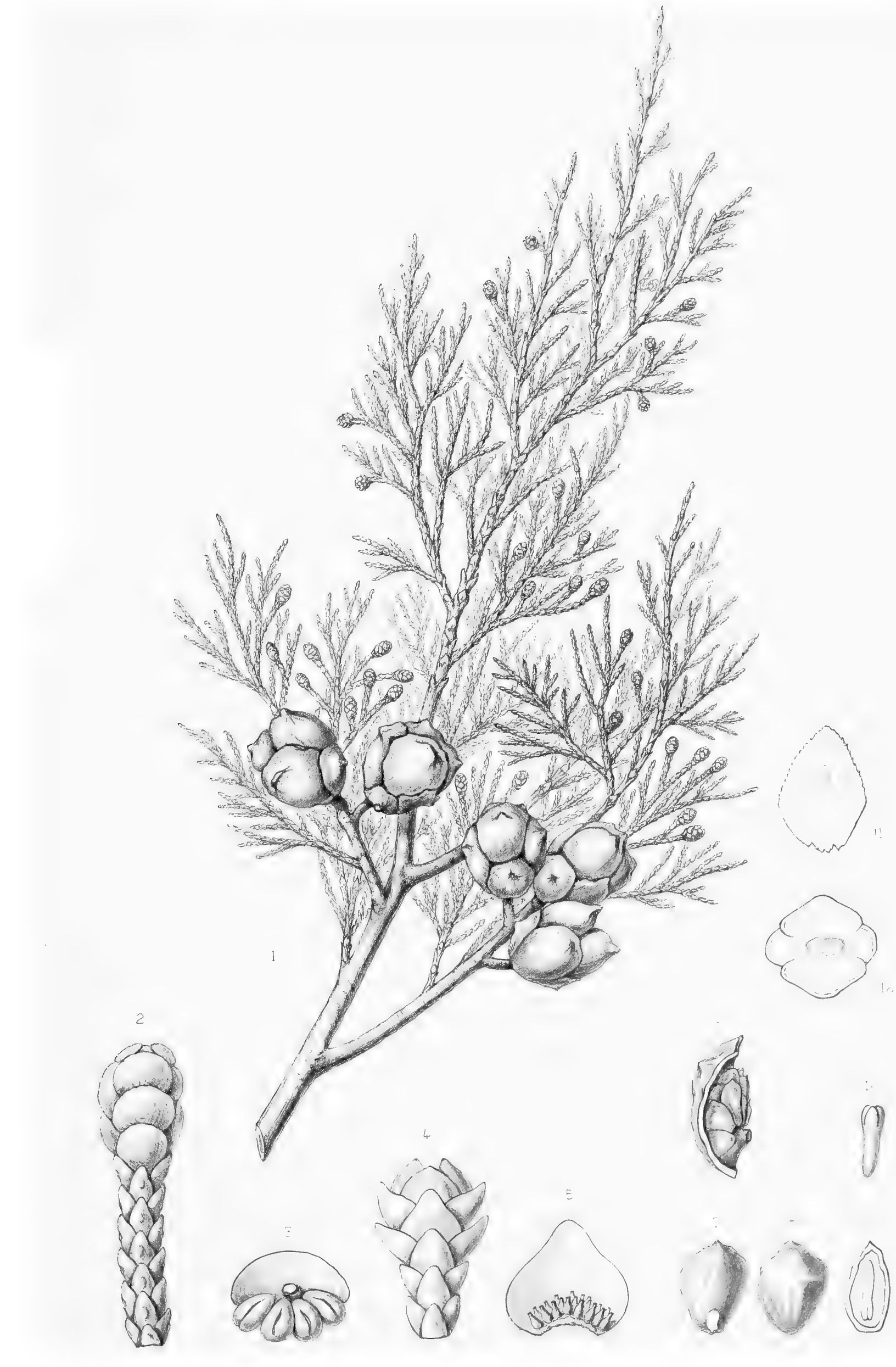
The specific name commemorates the horticultural and botanical labors of James MacNab,[1] the distinguished curator of the Edinburgh Botanic Garden.

[1] James MacNab (April 25, 1810–November 19, 1878), the son of William MacNab, curator of the Edinburgh Botanic Garden from 1810 to 1848, was born in Richmond, near London, and learned the theory and practice of horticulture under his father at Edinburgh. From 1829 to 1834 he served as clerk and assistant to the secretary of the Caledonian Horticultural Society, and in 1834 visited America, and traveled extensively in Canada and the United States, where he made a large herbarium and collections of living plants and seeds. An account of the interesting plants which he gathered during this journey was published in the *Edinburgh Philosophical Journal* of 1835 and in the early volumes of the *Transactions of the Botanical Society of Edinburgh.* Returning to Scotland in 1835, Mr. MacNab was appointed superintendent of the gardens of the Caledonian Horticultural Society at Inverleith, and held this position until the death of his father, whom he succeeded in the curatorship of the Edinburgh Botanical Garden, continuing to manage this institution during the remainder of his life, and greatly improving and enlarging it. He was one of the founders of the Edinburgh Botanical Society, and in 1872 served as its president. One of the best practical gardeners of his time, James MacNab was also the author of numerous papers on botany, horticulture, and arboriculture.

EXPLANATION OF THE PLATE.

PLATE DXXVIII. CUPRESSUS MACNABIANA.

1. A flowering and fruiting branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A pistillate flower, enlarged.
5. A scale of a pistillate flower with ovules, front view, enlarged
6. A scale of a cone with seeds, lateral view, enlarged.
7. A seed, back view, enlarged.
8. A seed, front view, enlarged.
9. Vertical section of a seed, enlarged.
10. An embryo, enlarged.
11. A leaf, enlarged.
12. Cross section of a branchlet, enlarged.



C. E. Faxon del

Rapine sc.

CUPRESSUS MACNABIANA, A. Murr.

A. Riocreux dirext.

Imp. J. Taneur, Paris.

CUPRESSUS THYOIDES.

White Cedar.

BRANCHLETS slender, compressed. Leaves dark blue-green, often conspicuously glandular.

Cupressus thyoides, Linnæus, *Spec.* 1003 (1753). — Miller, *Dict.* ed. 8, No. 5. — Muenchhausen, *Hausv.* v. 148. — Du Roi, *Harbk. Baumz.* ii. 198. —Wangenheim, *Beschreib. Nordam. Holz.* 45; *Nordam. Holz.* 8, t. 2, f. 4. — Marshall, *Arbust. Am.* 39. — Moench, *Bäume Weiss.* 33. — Lamarck, *Dict.* ii. 243. — Schoepf, *Mat. Med. Amer.* 144. — Castiglioni, *Viag. negli Stati Uniti*, ii. 228. — Willdenow, *Berl. Baumz.* 92; *Spec.* iv. pt. i. 512; *Enum.* 991. — Borkhausen, *Handb. Forstbot.* i. 461. — Michaux, *Fl. Bor.-Am.* ii. 208. — Schkuhr, *Handb.* iii. 286, t. 310. — *Nouveau Duhamel*, iii. 6, t. 2. — Persoon, *Syn.* ii. 580. — Desfontaines, *Hist. Arb.* ii. 567. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 448. — Michaux, *Hist. Arb. Am.* iii. 20, t. 2. — Pursh, *Fl. Am. Sept.* ii. 646. — Nuttall, *Gen.* ii. 224. — Hayne, *Dendr. Fl.* 178. — Elliott, *Sk.* ii. 644. — Watson, *Dendr. Brit.* ii. 156, t. 156. — Forbes, *Pinetum Woburn.* 183. — Hooker, *Fl. Bor.-Am.* ii. 165. — Bigelow, *Fl. Boston.* ed. 3, 387. — Torrey, *Fl. N. Y.* ii. 233. — Emerson, *Trees Mass.* 98; ed. 2, i. 114. — Richardson, *Arctic Searching Exped.* ii. 318. — Chapman, *Fl.* 435. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 28. — Hoopes, *Evergreens*, 346, f. 55. — K. Koch, *Dendr.* ii. pt. ii. 162. — Nördlinger, *Forstbot.* 459. — Veitch, *Man. Conif.* 238. — Lauche, *Deutsche Dendr.* ed. 2, 63. — Masters, *Jour. R. Hort. Soc.* xiv. 208; *Jour. Linn. Soc.* xxxi. 352. — Koehne, *Deutsche Dendr.* 150.

Cupressus palustris, Salisbury, *Prodr.* 398 (1796).

Thuya sphæroidea, Sprengel, *Syst.* iii. 889 (1826).

Thuya sphæroidalis, Richard, *Comm. Bot. Conif.* 45, t. 8, f. 2 (1826).

Chamæcyparis sphæroidea, Spach, *Hist. Vég.* xi. 331 (1842). — Endlicher, *Syn. Conif.* 61. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 207. — Knight, *Syn. Conif.* 20. — Carrière, *Traité Conif.* 133. — Gordon, *Pinetum*, 49. — Henkel & Hochstetter, *Syn. Nadelh.* 248. — (Nelson) Senilis, *Pinaceæ*, 69. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 464. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 177. — Watson & Coulter, *Gray's Man.* ed. 6, 493. — Mayr, *Wald. Nordam.* 193, t. 6, f., t. 8, f. — Beissner, *Handb. Nadelh.* 65, f. 12–15. — Hansen, *Jour. R. Hort. Soc.* xiv. 281 (*Pinetum Danicum*).

Chamæcyparis thyoides, Britton, *Cat. Pl. New Jersey*, 299 (1889). — Sudworth, *Rep. U. S. Dept. Agric.* 1892, 328.

A fragrant tree, seventy or eighty feet in height, with a tall trunk usually about two, but occasionally three or four feet in diameter, slender horizontal branches which form a narrow spire-like head, graceful distichous branchlets disposed in an open flat fan-shaped more or less deciduous spray, bright red-brown roots, and long thin brittle rootlets. The bark of the trunk is from three quarters of an inch to nearly an inch in thickness, light reddish brown, and divided irregularly into narrow flat connected ridges which are often spirally twisted round the stem, and separate into elongated loose or closely appressed plate-like fibrous scales. The branchlets are compressed during the first season, and then gradually become terete; they are slender, light green tinged with red when they first appear, light reddish brown during the first winter and then dark brown, their thin close bark beginning to separate slightly at the end of three or four years into small papery scales. The leaves are ovate, acuminate with slender callous tips, and closely appressed or spreading at the apex, especially on vigorous leading shoots, on which they are often remote; they are keeled and eglandular or conspicuously glandular-punctate on the back, dark dull blue-green, becoming at the north rusty brown during the winter when exposed to the sun, and from one sixteenth to one eighth of an inch in length; dying and turning a bright red-brown on leading shoots during their second season, they remain for many years on the branches; on seedling plants the leaves are linear-lanceolate, acuminate, light green above, marked below on each side of the prominent midrib with pale stomatiferous bands, and about a quarter of an inch long. The flowers appear in very early spring. The staminate flowers are oblong, four-sided, and about an eighth of an inch long, with five or six pairs of stamens, their connectives being ovate, rounded at

the apex, and decreasing in size from below upward, dark brown below the middle, nearly black toward the apex, and furnished with two pollen-sacs. The pistillate flowers are subglobose, from one sixteenth to one eighth of an inch long, with usually six ovate acute spreading pale liver-colored scales bearing generally two black ovules. The fruit, which ripens at the end of the first season, is globose and about a quarter of an inch in diameter, sessile on a short leafy branch, surrounded at the base by the persistent lower scales of the flower, with six scales furnished with thin ovate acute often reflexed bosses: it is light green and covered with a glaucous bloom when fully grown, then bluish purple and very glaucous, and finally dark red-brown. The seeds, of which there are usually one or two under each fertile scale, are ovate, acute, full and rounded at the base, slightly compressed, and about an eighth of an inch in length, with a thin testa produced into wings as broad as the body of the seed and darker in color, and a minute pale hilum.

Cupressus thyoides inhabits the cold swamps of the Atlantic and Gulf coast plains usually immersed during several months of the year, frequently covering them at the north with dense pure forests, or at the south mingling with the Bald Cypress. Rarely extending far inland,[1] it ranges from southern Maine[2] southward to northern Florida and westward to the valley of the Pearl River in Mississippi. Very abundant in New England south of Massachusetts Bay and in the middle and south Atlantic states, it is comparatively rare east of Boston and west of Mobile Bay.

The wood of *Cupressus thyoides* is light, soft, not strong, close-grained, easily worked, slightly fragrant, and very durable in contact with the soil. It seasons rapidly and perfectly without warping or checking; it is light brown tinged with red, with thin lighter colored sapwood, but grows darker with exposure, and contains dark-colored conspicuous narrow bands of small summer-cells and numerous obscure medullary rays.[3] The specific gravity of the absolutely dry wood is 0.3322, a cubic foot weighing 20.70 pounds. It is largely used in boatbuilding and cooperage, for wooden-ware, shingles,[4] the interior finish of houses, telegraph and fence posts and railway-ties, and for other purposes where a light soft durable wood easy to work and of even grain is desired.[5]

The earliest account of *Cupressus thyoides* appears in Morton's *New English Canaan*, published in London in 1635;[6] it was first described by Plukenet[7] in 1700 from a plant in Bishop Compton's[8] garden at Clapham, and, according to Aiton,[9] it was cultivated by Peter Collinson in 1736. The White Cedar is still found in European gardens, where a number of forms varying in habit and in the color and marking of the leaves have appeared and are prized by lovers of curious plants.[10]

One of the most beautiful of the coniferous trees of eastern America, the White Cedar is also one of the valuable timber-trees of the country, and its importance is increased by the fact that, attaining its greatest perfection in situations where no other useful timber-tree can flourish, it gives value to lands which without it would be worthless.

[1] The highest elevation at which the White Cedar has been reported above the sea-level is at High Point in New Jersey, a few miles from Port Jervis, New York, and close to the boundaries of New Jersey, New York, and Pennsylvania, where at an elevation of fifteen hundred feet it grows in a cold deep swamp. (See Gifford, *Garden and Forest*, ix. 63.)

[2] Goodale, *Proc. Portland Soc. Nat. Hist.* i. pt. ii. 129.

[3] Roth, *The Forester*, i. 15.

[4] Kalm, *Travels*, English ed. ii. 174. — Porcher, *Resources of Southern Fields and Forests*, 509.

[5] The wood of trunks of the White Cedar, which have probably lain for centuries buried deep in the swamps of New Jersey and Pennsylvania, retains its character and furnishes excellent lumber, and the mining of these trunks has proved a profitable industry.

[6] "Cypress, of this there is great plenty, and vulgarly this tree hath bin taken for an other sort of Cedar: but now men put a difference between this Cypress and the Cedars, especially in the color." (Force, *Historical Collections*, ii. No. 5, 44.)

"The white Cedar is a stately Tree, and is taken by some to be *Tamarisk*, this tree the *English* saw into boards to floor their rooms, for which purpose it is excellent, long lasting, and wears very smooth and white." (Josselyn, *Account of Two Voyages to New England*, 67.)

[7] *Cupressus nana Mariana fructu cæruleo parvo*, *Alm. Bot. Mant.* 61, t. 345, f. 1.

Cupressus semper virens seu cupressus Thyoides, Romans, *Nat. Hist. Florida*, 25.

[8] See i. 6.

[9] Aiton, *Hort. Kew.* iii. 372. — Loudon, *Arb. Brit.* iv. 2475, f. 2327.

[10] Beissner (*Handb. Nadelh.* 67) describes twelve of these garden forms, the most distinct, perhaps, being one which retains the juvenile leaves (*Cupressus thyoides ericoides*. *Chamæcyparis ericoides*, Carrière, *Traité Conif.* 140 (1855), and one in which the young branchlets and leaves are blotched with yellow (*Cupressus thyoides aurea*).

EXPLANATION OF THE PLATE.

PLATE DXXIX. CUPRESSUS THYOIDES.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, rear view, enlarged.
4. A stamen, front view, enlarged.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower with ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. A fruit, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A leaf, enlarged.
13. End of a branchlet, enlarged.
14. Cross section of a branchlet, enlarged.
15. A seedling, natural size.

C.E.Faxon del. *Rapine sc.*

CUPRESSUS THYOIDES, L.

A.Riocreux direct. *Imp. J.Taneur, Paris.*

CUPRESSUS NOOTKATENSIS.

Yellow Cypress. Sitka Cypress.

BRANCHLETS stout, slightly flattened or subterete. Leaves usually eglandular.

Cupressus Nootkatensis, Lambert, *Pinus*, ii. 18 (1824).— Nuttall, *Sylva*, iii. 105. — K. Koch, *Dendr.* ii. pt. ii. 165. — Lauche, *Deutsche Dendr.* ed. 2, 64, f. 7. — Masters, *Jour. R. Hort. Soc.* xiv. 206; *Jour. Linn. Soc.* xxxi. 352.

Chamæcyparis Nutkatensis, Spach, *Hist. Vég.* xi. 333 (1842). — Endlicher, *Syn. Conif.* 62. — Ledebour, *Fl. Ross.* iii. 680. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 207. — Carrière, *Traité Conif.* 134. — Walpers, *Ann.* v. 796. — Henkel & Hochstetter, *Syn. Nadelh.* 250. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 465. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 178. — Mayr, *Wald. Nordam.* 344, t. 6, f. — Beissner, *Handb. Nadelh.* 79, f. 18, 19. — Hansen, *Jour. R. Hort. Soc.* xiv. 280 (*Pinetum Danicum*).

Thuya excelsa, Bongard, *Mém. Phys. et Nat. Pt.* 2, *Acad. Sci. St. Pétersbourg*, ii. 164 (*Vég. Sitcha*) (1831).

Cupressus Nutkatensis, Hooker, *Fl. Bor.-Am.* ii. 165 (1839). — Newberry, *Pacific R. R. Rep.* vi. pt. iii. 63, f. 28. — Gordon, *Pinetum*, 66. — (Nelson) Senilis, *Pinaceæ*, 74. — Hoopes, *Evergreens*, 345. — Lawson, *Pinetum Brit.* ii. 199, t. 34, f. 1–12. — Veitch, *Man. Conif.* 235. — Schübeler, *Virid. Norveg.* i. 373. — Koehne, *Deutsche Dendr.* 50, f. 19.

Cupressus Americana, Trautvetter, *Pl. Imag. Fl. Russ.* 12, t. 7 (1844).

Thuiopsis borealis, Carrière, *Traité Conif.* 113 (1855).

Chamæcyparis Nutkaensis, *β* **glauca**, Walpers, *Ann.* v. 796 (1858).

A tree, often one hundred and twenty feet in height, with a tall trunk five or six feet in diameter, horizontal branches which form a narrow pyramidal head, stout distichous branchlets, and crowded elongated deciduous spray. The bark of the trunk is from one half to three quarters of an inch in thickness, light gray tinged with brown, irregularly fissured, and separated on the surface into large loose thin scales which in falling disclose the bright cinnamon-red inner bark. The branchlets are comparatively stout, somewhat flattened or subterete, light yellow often tinged with red when they first appear, dark or bright red-brown during their third season, when they are clothed with dead leaves, and ultimately paler and covered with close thin smooth bark. The leaves are ovate, long-pointed, rounded, eglandular or glandular-pitted on the back, dark blue-green, closely appressed, and about an eighth of an inch long, or on the vigorous leading branchlets somewhat spreading and often a quarter of an inch in length, with more elongated and sharper points; beginning to die at the end of their second year, they usually fall during the third season; those on seedling plants are acicular, spreading, light green, and from one quarter to one half of an inch in length. The flowers open in very early spring on lateral branchlets of the previous year, the staminate usually on the lower and the pistillate clustered near the ends of the upper branchlets. The staminate flower is oblong, nearly a quarter of an inch in length, and composed of four or five pairs of stamens, with ovate rounded slightly erose light yellow connectives more or less covered with a dark blotch and bearing usually two pollen-sacs. The pistillate flower is one sixteenth of an inch long and consists of ovate acute spreading dark liver-colored scales, the fertile bearing at their base from two to four ovules each. The fruit, which ripens in September and October, is subglobose, nearly half an inch in diameter, surrounded at the base by the slightly enlarged upper leaves of the branchlet, dark red-brown, and covered by a thick glaucous or blue bloom, with usually four or six scales, which are tipped with prominent erect pointed bosses, and are frequently covered with conspicuous resin-glands. From two to four seeds are produced under each fertile scale; they are ovate, acute, slightly flattened, about a quarter of an inch long, dark red-brown, and furnished with thin light red-brown wings often nearly twice as wide as the body of the seed.

Cupressus Nootkatensis is distributed from Sitka[1] southward through the islands and coast mountains of Alaska and British Columbia, along the Cascade Mountains of Washington and Oregon to the valley of the Santiam River and the slopes of Mt. Jefferson, and in Washington eastward to the headwaters of the Yakima River on the eastern slope of the range. In southern Alaska and northern British Columbia it attains its largest size in the forests of Spruce and Hemlock, ranging from the sea-level to elevations of two or three thousand feet; it is abundant at the sea-level on the west coast of Queen Charlotte's Islands;[2] it occurs sparingly in the interior of Vancouver's Island,[3] and on the high mountains immediately south of the Fraser River it grows to a large size in small isolated groups at an elevation of four thousand five hundred feet, and in small and shrubby forms a thousand feet higher. It is abundant in Washington on the Olympic Mountains and on the slopes of Mt. Ranier, frequently attaining the height of one hundred feet and forming a trunk three feet in diameter, while at high elevations it is reduced to a low shrub; farther south it is seldom large and is rare and local, growing usually as a low contorted tree on rocky cliffs and slopes generally at altitudes of about five thousand feet, or occasionally around the bases of the high isolated volcanic peaks descending to four thousand feet.

Cupressus Nootkatensis is one of the most valuable timber-trees of North America, producing wood which is unsurpassed for cabinet-making by that of any other inhabitant of the continent; it is light and hard, rather brittle, very close-grained, exceedingly durable in contact with the soil, and easily worked, with a satiny surface susceptible of receiving a beautiful polish. It has an agreeable resinous odor, and is bright clear light yellow, with very thin nearly white sapwood, thin inconspicuous bands of small summer-cells, and numerous hardly distinguishable medullary rays. The specific gravity of the absolutely dry wood is 0.4782, a cubic foot weighing 29.80 pounds. In Alaska and British Columbia it is used in boat and ship building, the interior finish of houses, and the manufacture of furniture, and for many years was exported in large quantities to China, where it was employed as a substitute for satinwood.

Cupressus Nootkatensis was discovered in October, 1793, on the shores of Nootka Sound by Menzies,[4] the surgeon and naturalist of Vancouver, on his voyage around the world. It was introduced into European gardens in 1850 through the Botanic Garden at St. Petersburg,[5] and has proved hardy in western and central Europe, where many forms with peculiar habit and abnormally colored foliage have been produced in nurseries,[6] and in the middle Atlantic states and in California, where it is occasionally cultivated.[7]

[1] Rothrock, *Smithsonian Rep.* 1867, 455 (*Fl. Alaska*) (*Thuya excelsa*). — Meehan, *Proc. Phil. Acad.* 1884, 92. — F. Kurtz, *Bot. Jahrb.* xix. 425 (*Fl. Chilcatgebietes*). — Funston, *Contrib. U. S. Nat. Herb.* iii. 328.

[2] G. M. Dawson, *Can. Nat.* ser. 2, ix. 329.

[3] Macoun, *Cat. Can. Pl.* 461 (*Thuya excelsa*).

[4] See ii. 90.

[5] Veitch, *Man. Conif.* 235.

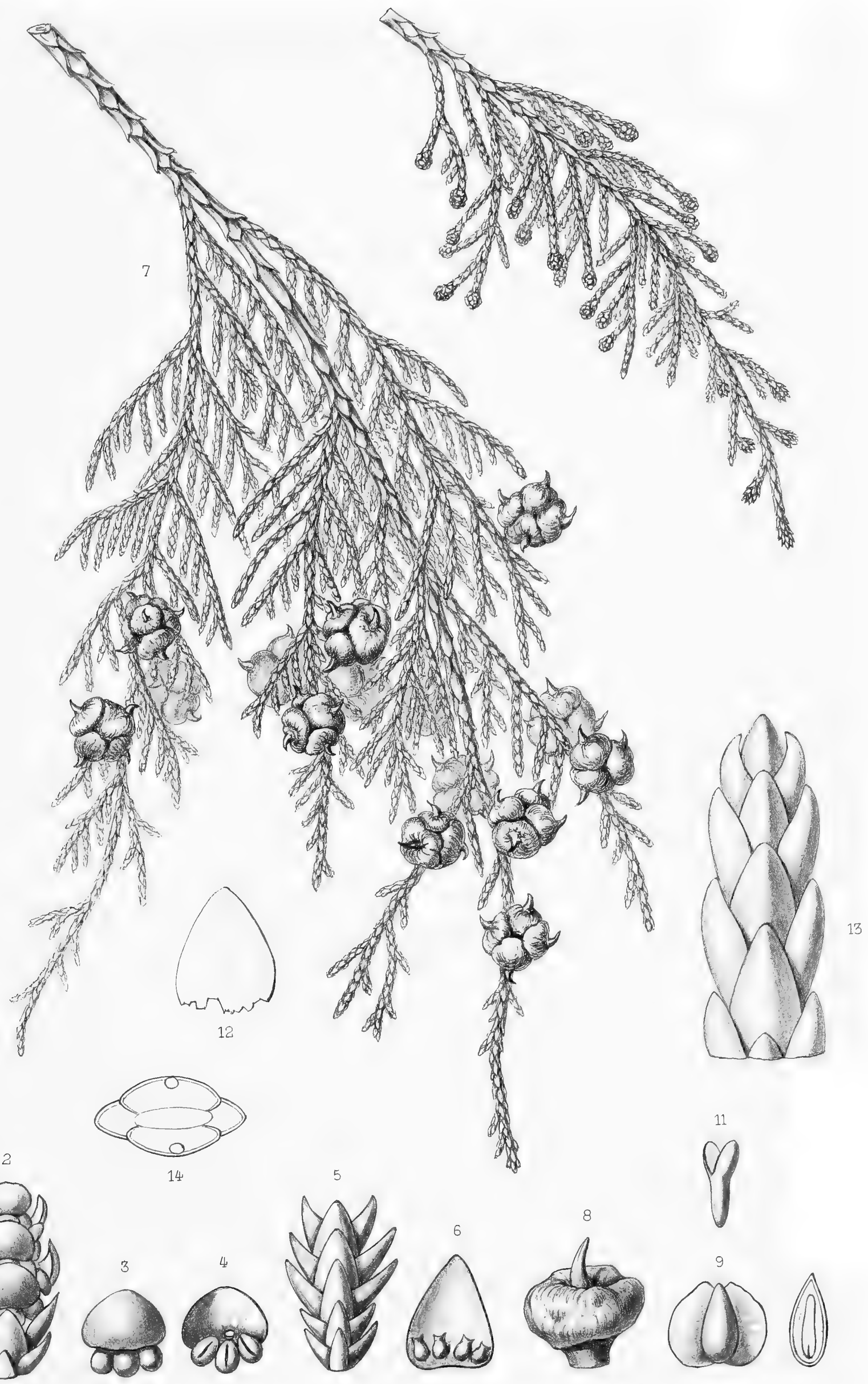
[6] Beissner, *Handb. Nadelh.* 82.

[7] In the gardens of the United States and usually also in those of Europe, *Cupressus Nootkatensis* is cultivated under the name of *Thujopsis borealis*. In European gardens it is also occasionally cultivated as *Thujopsis Tchugatskoy* and as *Thujopsis Tchugatskoyæ*.

EXPLANATION OF THE PLATE.

PLATE DXXX. CUPRESSUS NOOTKATENSIS.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, rear view, enlarged.
4. A stamen, front view, enlarged.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower with ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. A scale of a fruit, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A leaf, enlarged.
13. End of a branchlet, enlarged.
14. Cross section of a branchlet, enlarged.



C.E. Faxon del.

Rapine sc.

CUPRESSUS NOOTKATENSIS, Lamb.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

CUPRESSUS LAWSONIANA.

Port Orford Cedar. Lawson's Cypress.

BRANCHLETS slender, compressed. Leaves conspicuously glandular. Staminate flowers bright red. Bark thick, deeply furrowed.

Cupressus Lawsoniana, A. Murray, *Edinburgh New Phil. Jour.* n. ser. i. 292, t. 10 (1855); *The Garden*, vii. 508, t. — *Bot. Mag.* xci. t. 5581. — Henkel & Hochstetter, *Syn. Nadelh.* 246. — (Nelson) Senilis, *Pinaceæ*, 72. — Hoopes, *Evergreens*, 342, f. 53. — Veitch, *Man. Conif.* 231. — Eichler, *Monatsb. Acad. Berl.* 1881, f. 29, 30. — Lauche, *Deutsche Dendr.* ed. 2, 63. — Lawson, *Pinetum Brit.* ii. 191, t. 31, f. 1–13. — Schübeler, *Virid. Norveg.* i. 374. — Masters, *Jour. R. Hort. Soc.* xiv. 205; *Jour. Linn. Soc.* xxxi. 353, f. 28. — Koehne, *Deutsche Dendr.* 51.

Cupressus fragrans, Kellogg, *Proc. Cal. Acad.* i. 103 (1856).

Cupressus attenuata, Gordon, *Pinetum*, 57 (1858).

Chamæcyparis Lawsonii, Parlatore, *Ann. Mus. Stor. Nat. Firenze*, i. 175, t. 3, f. 22–25 (*Stud. Organ. Conif.*) (1864).

Chamæcyparis Lawsoniana, Parlatore, *De Candolle Prodr.* xvi. pt. ii. 464 (1868). — Gordon, *Pinetum*, ed. 2, 85. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 114. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 178. — Willkomm, *Forst. Fl.* ed. 2, 247. — Mayr, *Wald. Nordam.* 314, f. 12, t. 6, f. t. 8, f. — Lemmon, *Rep. California State Board Forestry*, iii. 177, t. 24 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 74. — Beissner, *Handb. Nadelh.* 70, f. 16, 17. — Hansen, *Jour. R. Hort. Soc.* xiv. 278 (*Pinetum Danicum*). — R. Hartig, *Forstbot. Zeit.* 1892, 21.

Cupressus Boursierii, Carrière, *Traité Conif.* ed. 2, 125 (1867).

Cupressus Nutkana, Torrey, *Bot. Wilkes Explor. Exped.* t. 16 (1874).

? Cupressus Balfouriana, Gordon, *Pinetum*, ed. 2, 79 (1879).

A tree, often two hundred feet in height, with a tall trunk frequently twelve feet in diameter above its abruptly enlarged base and often free of branches for one hundred and fifty feet, small horizontal or pendulous branches which form a narrow spire-like head, and slender branchlets clothed with remote narrow flat spray frequently six or eight inches in length. The bark of the trunk, which is often ten inches in thickness at the base of old trees, is three or four inches thick on smaller stems; it is dark reddish brown, with two distinct layers, the inner being from an eighth to a quarter of an inch in thickness, darker, more compact and firmer than the outer, which is divided into great broad-based rounded ridges separated on the surface into small thick closely appressed scales; on young stems and on the branches the bark is thin, dark reddish brown and slightly scaly. The branchlets are slender, compressed during the first season, light green for two years, and then light reddish brown. The leaves on lateral branchlets are ovate, acute, conspicuously glandular on the back, closely appressed, usually not more than one sixteenth of an inch long, and bright green; on leading shoots they are long-pointed and often spreading at the apex, from an eighth to nearly a quarter of an inch in length, and usually die, turn bright red-brown, and fall during the third year or occasionally remain another season on the branches; on seedling plants they are linear-lanceolate, thin and spreading, acute or rounded at the apex, from one quarter to one half of an inch in length, and bright green with obscure midribs. The flowers appear in early spring, the staminate with bright red connectives bearing usually two pollen-sacs, and the pistillate with dark ovate acute spreading scales. The fruit, which is clustered on the upper lateral branchlets and is usually produced in great profusion, ripens in September and October; it is globose, about a third of an inch in diameter, pale green and glaucous when fully grown, and red-brown and often covered with a bloom at maturity, with eight or ten rugose scales furnished with thin broadly ovate acute reflexed bosses. From two to four seeds are produced under each fertile scale; they are ovate, acute, slightly compressed, an eighth of an inch long, and light chestnut-brown, with thin broad wings.

Cupressus Lawsoniana is distributed from the shores of Coos Bay in southwestern Oregon southward to the mouth of the Klamath River, California, and ranges inland for about thirty miles from the coast; it occurs on the mountains near Waldo in Josephine County, Oregon, and in small isolated groves on the slopes of the Siskiyou Mountains and on the southern flanks of Mt. Shasta in California, where, growing on the banks of streams and lakes at an elevation of about five thousand feet above the sea, it was discovered in the autumn of 1854 by Mr. William Murray. North of Rogue River on the coast of Oregon it is most abundant, and, mingled with *Pseudotsuga taxifolia*, *Picea Sitchensis*, *Thuya gigantea*, *Tsuga Mertensiana*, and *Abies grandis*, forms one of the most prolific and beautiful coniferous forests of the continent, unsurpassed in the variety and luxuriance of its undergrowth of Rhododendrons, Vacciniums, Raspberries, Buckthorns, and Ferns. Here *Cupressus Lawsoniana* grows on rather high dry sandy ridges, its seedlings soon covering the ground which has been stripped of its forest mantle, and flourishes even on the sand-dunes of sea-beaches, where it is often bathed in saline spray. It attains its largest size, however, on the western slopes of the Coast Range foothills, where, about three miles from the shore, between Point Gregory and the mouth of the Coquille River, it is the principal tree in a nearly continuous forest belt about twenty miles in length and twelve in width.[1]

Cupressus Lawsoniana, which is probably the largest and most valuable of the Cupressineæ, and remarkable for the great thickness of the bark of its trunk, is one of the important timber-trees of North America. The wood is light, hard, strong, and very close-grained, abounding in fragrant resin, and is very durable in contact with the soil and easily worked, with a satiny surface susceptible of receiving a beautiful polish; it is light yellow or almost white, with thin hardly distinguishable sapwood, and contains thin inconspicuous layers of small summer-cells and numerous obscure medullary rays. The specific gravity of the absolutely dry wood is 0.4621, a cubic foot weighing 28.80 pounds. It is largely manufactured into lumber, and on the Pacific coast is used for the interior finish and flooring of buildings, for railway-ties and fence-posts, in ship and boat building, and almost exclusively in the manufacture of matches. The resin is a powerful diuretic.[2]

Cupressus Lawsoniana[3] was first cultivated in the nursery of Peter Lawson & Company of Edinburgh, where it was raised from seeds sent from California in 1854 by William Murray. With its delicate feathery branches, its graceful drooping leading shoots, and its light and cheerful color, *Cupressus Lawsoniana* in youth is one of the most beautiful of the conifers cultivated in gardens. In western, central, and southern Europe, where it has already attained a considerable size, it is a favorite ornament of parks and gardens, and under cultivation has developed many abnormal forms.[4] It is occasionally planted in the middle and south Atlantic states, although here it displays less beauty than in western Europe.

The specific name commemorates Sir Charles Lawson[5] of Bothwick Hall, Mid-Lothian, the distinguished rural economist, and Lord Provost of the city of Edinburgh.

[1] Sargent, *Gard. Chron.* n. ser. xvi. 8.

[2] The odor of the resin of the newly cut wood is so powerful that men employed in the saw-mills where it is manufactured into lumber become, at the end of a few days, so weakened by diuresis that they have to abandon work unless a change to some other wood is made.

[3] In Oregon *Cupressus Lawsoniana* is also called Oregon Cedar, White Cedar, and Ginger Pine.

[4] See *Gard. Chron.* 1870, 279, f. 49 (*Cupressus Lawsoniana, erecta viridis*). — *Gard. Chron.* ser. 3, i. 176, f. 41. — *The Garden*, xxx. 75. — Beissner, *Handb. Nadelh.* 72.

[5] Charles Lawson (1794–1873) was a son of Peter Lawson, the founder of the seed and nursery business of Peter Lawson & Sons, of Edinburgh. In 1821 he succeeded his father, with whom he had been associated, in the management of the affairs of the firm, which by his intelligence and energy he soon made a power in the development of Scottish agriculture, extending its connections to all parts of the world. He introduced many useful plants into his native land, including the Italian Rye-grass, the Austrian Pine, and Lawson's Cypress. He was the author of *The Agrostographia, or Book of Grasses*, which passed through several editions and was long considered the standard British book on agricultural grasses, and of *The Agriculturist's Manual*, published in 1836, and containing familiar descriptions of the agricultural plants cultivated in Europe, with practical observations respecting those suited to the climate of Great Britain. Some time before his death Mr. Lawson began the publication of the *Pinetum Britannicum*, an illustrated folio devoted to the description of the hardy coniferous trees cul-

tivated in Great Britain. This book, which suffered a number of interruptions, was finally completed by several editors in 1884 in three volumes, one hundred copies only being printed. Mr. Lawson's active participation in the affairs of his firm ceased about 1850, although he remained a partner during the rest of his life, which he devoted to the public affairs of Edinburgh, becoming chairman of the Chamber of Commerce, Master of the Merchants' Company, and in 1861 Lord Provost. (See *The Scotsman*, December 13, 1873.)

EXPLANATION OF THE PLATE.

PLATE DXXXI. CUPRESSUS LAWSONIANA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A stamen, rear view, enlarged.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower with its ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. A scale of a fruit, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A leaf, enlarged.
13. End of a branchlet, enlarged.
14. Cross section of a branchlet, enlarged.
15. A seedling, natural size.

C.E.Faxon del. *Himely sc.*

CUPRESSUS LAWSONIANA, A. Murr.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

THUYA.

FLOWERS naked, monœcious, terminal, solitary; stamens decussately opposite; anther-cells 2 to 4; scales of the pistillate flower 8 to 12, oblong, acute; ovules 2 or 3. Fruit an erect strobile maturing in one season. Leaves dimorphic, persistent.

Thuya, Linnæus, *Gen.* 378 (1737). — A. L. de Jussieu, *Gen.* 413. — Endlicher, *Gen.* 258. — Meisner, *Gen.* 352. — Bentham & Hooker, *Gen.* iii. 426 (excl. secs. Thuyopsis and Chamæcyparis). — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 97. — Baillon, *Hist. Pl.* xii. 34 (in part). — Masters, *Jour. Linn. Soc.* xxx. 19.

Biota, D. Don, *Lambert Pinus,* ed. 2, ii. 129 (1828). — Endlicher, *Gen.* Suppl. iv. pt. ii. 3.

Platycladus, Spach, *Hist. Vég.* xi. 333 (in part) (1842).

Resinous aromatic trees, with thin scaly bark, soft light yellow or red-brown durable straight-grained slightly fragrant wood, slender spreading or erect branches, pyramidal heads, flattened lateral pendulous or erect branchlets disposed in one horizontal plane forming an open distichous spray usually pale and stomatiferous below and often ultimately deciduous, naked buds and fibrous roots. Leaves opposite, imbricated in four ranks, scale-like, ovate, acute, glandular or eglandular on the back, persistent; on leading shoots nearly equally decussate, appressed or spreading, remote by the lengthening of the nodes, rounded or slightly keeled on the back, acuminate with long slender points; on lateral branchlets, those of the lateral ranks much compressed, conspicuously carinate, and nearly covering those of the other ranks; on seedling plants linear-lanceolate, acuminate, spreading or reflexed, pale and stomatiferous on the lower surface. Flowers minute, monœcious, appearing in very early spring from buds formed the previous winter, the staminate and pistillate usually on different branchlets, terminal, solitary. Staminate flower ovoid, composed of a subsessile axis, with four or six decussately opposite stamens; filaments short, enlarged into suborbicular eccentrically peltate connectives bearing on their inner face from two to four subglobose two-valved pendulous anther-cells opening below longitudinally; pollen-grains simple. Pistillate flower ovoid or oblong, composed of from eight to twelve erect oblong acute slightly imbricated decussate scales, the central, or the lower (Biota) fertile, slightly thickened at the base on the inner surface by the ovuliferous scales bearing from two to four erect collateral orthotropous bottle-shaped ovules. Fruit ripening the first season, pale cinnamon brown, ovoid-oblong, erect; scales thin, leathery, oblong, acute, marked near the apex by the thickened more or less free mucronulate border of the enlarged flower-scales, those of the two or three middle ranks larger than the others, and fertile, with two or rarely three seeds, or, under the lowest, with one (Euthuya); or oblong, somewhat fleshy when fully grown, becoming woody at maturity, with thicker conspicuously umbonate scales, the lowest four usually fertile, and bearing each from two to four seeds (Biota). Seeds erect on the base of the scale, ovate, acute, compressed, light chestnut-brown; testa membranaceous, produced into broad lateral wings, distinct at the apex, often slightly unequal and lighter colored than the body of the seed; hilum minute (Euthuya); or thickened, rounded or obscurely angled on the back, wingless, dark red-purple, marked on the oblique base by large oblong pale hilums; seed-coat thick, of two layers, the outer thick and crustaceous, marked externally with rufous fibres, the inner membranaceous (Biota). Embryo axile,[1] in copious fleshy albumen; cotyledons two, longer than the superior radicle.[2]

[1] Mirbel & Spach, *Ann. Sci. Nat.* sér. 2, xx. 261, t. 10.

[2] By Eichler (Engler & Prantl, *Pflanzenfam.* ii. pt. i. 97) Thuya has been divided into the following sections: —

EUTHUYA. (Euthuya and Macrothuya, Bentham & Hooker, *Gen.* iii. 427). Fruit erect, its scales thin, leathery, oblong, acute, mucronulate, those of the two or three middle ranks larger than the others and fertile; seeds compressed, light chestnut-brown,

Four species of Thuya are known; one species, the type of the genus, inhabits northeastern North America, and one inhabits northwestern North America; another grows on the mountains of central Japan,[1] and the fourth in China.[2] The type is an ancient one, and during the tertiary period Thuya was widely distributed through both hemispheres.[3]

Thuya produces valuable wood used in construction and for purposes where durability in contact with the soil is demanded. The eastern American species, which contains a volatile oil and thujin, a crystalline principle, possesses stimulating properties, and is occasionally used medicinally in the United States. The bark of Thuya is rich in tannin.[4] Its species are valuable ornamental trees, and with their varieties are cultivated in the parks and gardens of all temperate countries.

In North America Thuya is not seriously injured by insects[5] or fungal diseases.[6]

the membranaceous testa produced into broad lateral wings; hilum minute.

Biota. Fruit erect, its scales thick, conspicuously umbonate, the lowest four usually fertile, and bearing from two to four seeds each; seeds thickened, rounded or obscurely angled on the back, wingless, the thick seed-coat dark red-purple; hilum large, oblong, conspicuous.

[1] *Thuya Standishii*, Carrière, *Traité Conif.* ed. 2, 108 (1867). — Masters, *Gard. Chron.* n. ser. xiii. 589, f. 102. — Beissner, *Handb. Nadelh.* 49.

Thujopsis ? Standishii, Gordon, *Pinetum*, Suppl. 100 (1865). — Henkel & Hochstetter, *Syn. Nadelh.* 289.

Thuya Japonica, Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, x. 490 (*Mél. Biol.* vi. 26) (1866). — Masters, *Jour. Linn. Soc.* xviii. 486 (*Conifers of Japan*).

Thuya gigantea, Parlatore, *De Candolle Prodr.* xvi. pt. ii. 457 (in part) (not Nuttall) (1868). — K. Koch, *Dendr.* ii. pt. ii. 176.

Thuya gigantea var. *Japonica*, Franchet & Savatier, *Enum. Pl. Jap.* i. 469 (1875).

A rare inhabitant of the forests of central Hondo, the Japanese Arbor-vitæ is a pyramidal tree occasionally thirty feet high, growing by the borders of streams and lakes at elevations of from four to five thousand feet above the level of the sea. It was introduced into European and American gardens about thirty years ago, and in the United States has proved hardy in eastern Massachusetts, where a plant about eighteen feet high in Mr. Hunnewell's Pinetum at Wellesley has ripened its fruit.

[2] *Thuya orientalis*, Linnæus, *Spec.* 1002 (1753). — Thunberg, *Fl. Jap.* 266. — Willdenow, *Spec.* iv. pt. i. 509. — Richard, *Comm. Bot. Conif.* 40, t. 7, f. 2. — Siebold & Zuccarini, *Fl. Jap.* ii. 31, t. 118. — Masters, *l. c.* 488.

Thuya acuta, Moench, *Meth.* 692 (1794).

Thuya decora, Salisbury, *Prodr.* 398 (1796).

Cupressus Thuya, Targioni-Tozzetti, *Obs. Bot.* iii.–v. 72 (1808–10).

Platycladus stricta, Spach, *Hist. Vég.* xi. 335 (1842).

Biota orientalis, Endlicher, *Syn. Conif.* 47 (1847). — Carrière, *Traité Conif.* 92. — Gordon, *Pinetum*, 32. — Henkel & Hochstetter, *Syn. Nadelh.* 270. — Miquel, *Ann. Mus. Lugd. Bat.* iii. 167 (*Prol. Fl. Jap.*). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 461. — K. Koch, *Dendr.* ii. pt. ii. 181. — Franchet & Savatier, *Enum. Pl. Jap.* i. 470.

This slender dense bushy bright green tree inhabits the mountain forests of central and northern China, and in cultivation rarely attains a height of twenty feet. Although it has generally been considered indigenous in Japan, it was probably introduced there by Buddhist priests. For centuries it has been a favorite garden plant in Japan, where numerous seminal varieties have been propagated and whence it was carried to Europe about the middle of the eighteenth century; it is now one of the most generally cultivated coniferous plants in the gardens of all temperate countries. Curious among the innumerable varieties which have been raised from its seeds, and which are mostly distinguished by their more open or their dwarfer habit and by the color of their foliage, which in some forms is bright golden, is the tree with long slender flexible pensile branchlets found by Thunberg in the temple gardens of Japan, and for many years believed to be a distinct species. It is:

Thuya orientalis, var. *β pendula*, Masters, *l. c.* (1881).

Cupressus pendula, Thunberg, *l. c.* 265 (1784).

Cupressus patula, Persoon, *Syn.* ii. 580 (1807).

Thuya pendula, Lambert, *Pinus*, ed. 2, ii. 115, t. (1828). — Siebold & Zuccarini, *l. c.* 30, t. 117. — Forbes, *Pinetum Woburn.* 197, t. 63. — Miquel, *l. c.*

Thuya filiformis, Lindley, *Bot. Reg.* xxviii. t. 20 (1842).

Biota pendula, Endlicher, *l. c.* 49. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 205. — Carrière, *l. c.* 97. — Gordon, *l. c.* 35.

Biota orientalis filiformis, Henkel & Hochstetter, *l. c.* 272 (1865).

Biota orientalis, *β pendula*, Parlatore, *l. c.* 462 (1868).

For other varieties of *Thuya orientalis*, see Veitch, *Man. Conif.* 252. — Beissner, *l. c.* 56. — Masters, *Jour. R. Hort. Soc.* xiv. 252.

[3] Saporta, *Origine Paléontologique des Arbres*, 98. — Zittel, *Handb. Palæontolog.* ii. 320.

[4] Trimble, *Garden and Forest*, ix. 162.

[5] Few species of insects are known to live upon Thuya in North America, and only two or three cause serious injury to healthy trees. No borers in the living wood are recorded, although the larvæ of several species of beetle live under the bark of dead trees. Among foliage destroyers, the Bag-worm, *Thyridopteryx ephemeræformis*, Haworth, sometimes injures trees planted in the regions south of Massachusetts; but it does not seem to thrive in the north or to affect trees growing naturally. Among other Lepidoptera found feeding on Thuya, but not known to be specially injurious to it, are *Attacus Promethea*, Harris, *Eupithecia miserulata*, Grote, *Ematurga Faxonii*, Minot, and *Bucculatrix thuiella*, Packard. *Lophyrus Abietis*, Harris, and probably the larvæ of other sawflies, are also occasionally found on this tree. A mite, *Phytoptus Thuyæ*, Garman, has been described as occurring on *Thuya occidentalis*, cultivated in Illinois.

[6] Little is known of the fungi which attack the western *Thuya gigantea* in its native forests, but planted trees in Germany have suffered from *Pestalozzia funerea*, Desmazières, which causes the death of the young branches (see *Gard. Chron.* ser. 3, xix. 554); and *Thuya occidentalis* does not suffer seriously from fungal disease. The species which have been noted on this tree are mostly small forms of Discomycetes, Hysteriaceæ, and various *Fungi Imperfecti*

Plants of the species can be easily raised from seeds, and the varieties can be propagated by cuttings made from young branches.

Thuya,[1] the classical name of some coniferous trees, was adopted by Tournefort[2] and afterward by Linnæus for this genus.

which also attack related genera, like *Pitya Cupressi*, Saccardo, which also occurs on *Cupressus thyoides*.

[1] Thuya has been written Thya (Rumphius, *Fl. Jen.* 315 [1718]. — Adanson, *Fam. Pl.* ii. 480), Thuja (Linnæus, *Hort. Cliff.* 449 [1737]; *Spec.* 1002), and Thuia (Scopoli, *Introduct.* 353 [1777]).

[2] *Inst.* 586, t. 358.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

EUTHUYA. Fruit erect, its thin scales mucronulate; seeds compressed, the thin testa produced into broad lateral wings.

- Fruit small, with usually four fertile scales . . . . . 1. T. OCCIDENTALIS.
- Fruit larger, with usually six fertile scales . . . . . 2. T. GIGANTEA.

THUYA OCCIDENTALIS.

White Cedar. Arbor-Vitæ.

FRUIT small, with usually 4 fertile scales. Wood light yellow-brown.

Thuya occidentalis, Linnæus, *Spec.* 1002 (excl. hab. Sibe-ria) (1753). — Miller, *Dict.* ed. 8, No. 1. — Muenchhausen, *Hausv.* v. 333. — Wangenheim, *Beschreib. Nordam. Holz.* 49; *Nordam. Holz.* 7, t. 2, f. 3. — Marshall, *Arbust. Am.* 152. — Moench, *Bäume Weiss.* 135. — Evelyn, *Silva*, ed. Hunter, ii. 35. — Walter, *Fl. Car.* 238. — Castiglioni, *Viag. negli Stati Uniti*, ii. 386. — Gærtner, *Fruct.* ii. 62, t. 91. — Willdenow, *Berl. Baumz.* 383; *Spec.* iv. pt. i. 508; *Enum.* 990. — Borkhausen, *Handb. Forstbot.* i. 456. — *Nouveau Duhamel*, iii. 12, t. 4. — Michaux, *Fl. Bor.-Am.* ii. 209. — Schkuhr, *Handb.* iii. 287, t. 309. — Poiret, *Lam. Dict.* vii. 639; *Ill.* iii. 369, t. 787. — Persoon, *Syn.* ii. 580. — Desfontaines, *Hist. Arb.* ii. 575. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 452. — Titford, *Hort. Bot. Am.* 98. — Stokes, *Bot. Mat. Med.* iv. 437. — Michaux f. *Hist. Arb. Am.* iii. 29, t. 3. — Pursh, *Fl. Am. Sept.* ii. 646. — Nuttall, *Gen.* ii. 224. — Hayne, *Dendr. Fl.* 177. — Elliott, *Sk.* i. 641. — Jaume St. Hilaire, *Traité des Arbres Forestiers*, t. 87. — Watson, *Dendr. Brit.* ii. 150, t. 150. — Sprengel, *Syst.* iii. 888. — Richard, *Comm. Bot. Conif.* 43, t. 7, f. 1. — Forbes, *Pinetum Woburn.* 193. — Hooker, *Fl. Bor.-Am.* ii. 165. — Bigelow, *Fl. Boston.* ed. 3, 388. — Spach, *Hist. Vég.* xi. 339. — Torrey, *Fl. N. Y.* ii. 234. — Emerson, *Trees Mass.* 96; ed. 2, i. 112. — Endlicher, *Syn. Conif.* 51. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 206. — Knight, *Syn. Conif.* 16. — Darlington, *Fl. Cestr.* ed. 3, 294. — Carrière, *Rev. Hort.* 1854, 225; *Traité Conif.* 103. — Gordon, *Pinetum*, 323. — Chapman, *Fl.* 436. — Henkel & Hochstetter, *Syn. Nadelh.* 278. — (Nelson) Senilis, *Pinaceæ*, 68. — R. Brown Campst. *Trans. Bot. Soc. Edinburgh*, ix. 363. — Hoopes, *Evergreens*, 317. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 458. — Schnizlein, *Icon.* t. 76, f. 2. — K. Koch, *Dendr.* ii. pt. ii. 173. — Nördlinger, *Forstbot.* 465, f. — Veitch, *Man. Conif.* 261. — Regel, *Russ. Dendr.* ed. 2, 18. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 176. — Lauche, *Deutsche Dendr.* ed. 2, 67, f. 8. — Schübeler, *Virid. Norveg.* i. 370. — Willkomm, *Forst. Fl.* ed. 2, 249. — Watson & Coulter, *Gray's Man.* ed. 6, 494. — Mayr, *Wald. Nordam.* 196, t. 6, f., t. 8, f. — Beissner, *Handb. Nadelh.* 32, f. 3–5. — Masters, *Jour. R. Hort. Soc.* xiv. 252. — Hansen, *Jour. R. Hort. Soc.* xiv. 272 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 48.

Thuya odorata, Marshall, *Arbust. Am.* 152 (1785).

Thuya obtusa, Mœnch, *Meth.* 691 (1794).

Thuya procera, Salisbury, *Prodr.* 398 (1796).

Cupressus Arbor-vitæ, Targioni-Tozzetti, *Obs. Bot.* iii.–v. 71 (1808–10).

A tree, fifty or sixty feet in height, with a short often lobed and buttressed trunk occasionally six, although usually not more than two or three feet in diameter, often dividing into two or three stout upright secondary stems, and with short horizontal branches which soon turn upward and form a narrow rather compact head, and deciduous pendulous lateral branchlets three or four inches in length. The bark of the trunk is from one quarter to one third of an inch in thickness and is light red-brown often tinged with orange-color and broken by shallow fissures into narrow flat connected ridges which separate into elongated fibrous more or less persistent scales. The branchlets when they first appear are light yellow-green and paler on the lower surface than on the upper, changing with the death of the leaves during their second season to light cinnamon-red and growing darker during the following year; gradually becoming terete and abruptly enlarged at the base, they are finally covered with smooth lustrous dark orange-brown bark and marked by conspicuous elevated scars left by the falling of the lateral branchlets. On leading shoots the leaves are often nearly a quarter of an inch in length, long-pointed, and usually conspicuously glandular; on lateral branchlets they are much flattened, rounded and apiculate at the apex, eglandular or obscurely glandular-pitted, and about an eighth of an inch long. The flowers open in April and May and are liver-colored. The fruit ripens and discharges its seeds in the early autumn, but remains on the branch until after the appearance of the new growth the following spring; it varies from one third to nearly one half of an inch in length; the scales of the two central ranks are

fertile, although those of the lower of these ranks often bear only single seeds. The seed is about an eighth of an inch long and nearly surrounded by thin wings as wide as its body.

Thuya occidentalis is distributed from the neighborhood of Annapolis, Nova Scotia, through New Brunswick, Quebec, and Ontario, where it is abundant, northward nearly to Lake Mistassinni and the shores of James Bay, the line of the northern limits of its range, then crossing the Albany River at some distance from its mouth, trends southwestward to the southern borders of Lake Winnipeg, its most northwesterly recorded station being on the shores of Cedar Lake, near the mouth of the Saskatchewan;[1] it ranges through the northern states to southern New Hampshire, central Massachusetts and New York, northern Pennsylvania, central Michigan, northern Illinois and central Minnesota, and along the high Alleghany Mountains to southern Virginia. Very common in the north, except in the elevated mountain regions of northern New England and New York, and the coast region south of New Hampshire, it is frequently spread over great areas of springy swamp-land, which it covers with nearly impenetrable forests, and often occupies the rocky banks of streams where its roots can penetrate between the crevices of the ledges and obtain an abundant supply of moisture. Toward the southern limits of its range it is less abundant and smaller, and on the southern Alleghany Mountains it is found only at high elevations on the borders of streams where individual trees sometimes grow to a large size.

The wood of *Thuya occidentalis* is light, soft, brittle, and rather coarse-grained, and very durable in contact with the soil; it is fragrant and light yellow-brown, turning darker with exposure, with thin nearly white sapwood, and contains thin dark-colored bands of small summer-cells and numerous obscure medullary rays. The specific gravity of the absolutely dry wood is 0.3164, a cubic foot weighing 19.72 pounds. It is largely used in Canada and the northern states for fence-posts and rails, railway-ties, and shingles. The thick layers of sapwood, which are easily separated, are manufactured by the Canadian Indians into baskets and are used to strengthen birch-bark canoes;[2] and the fresh branches frequently serve as brooms.[3] Fluid extracts and tinctures are made from the young branchlets, and are sometimes employed in the treatment of amenorrhœa and catarrhal affections, and externally to remove warts and fungal growths,[4] and also in homœopathic practice.[5]

Thuya occidentalis, which was probably the first North American tree introduced into Europe, was cultivated in Paris before the middle of the sixteenth century, and the earliest account of it was published by Belon in 1558.[6] For at least a hundred years it has been a favorite garden plant, and in cultivation has produced many forms distinguished by their abnormal habit and by the coloring of the leaves, which sometimes are bright yellow;[7] in the northern United States it has been largely planted to form hedges,[8] although on high dry ground, or when fully exposed to the wind, these frequently suffer during severe winters.

[1] Brunet, *Cat. Vég. Lig. Can.* 59. — Bell, *Rep. Geolog. Surv. Can.* 1879–80, 47°. — Macoun, *Cat. Can. Pl.* 459.

[2] Provancher, *Flore Canadienne*, ii. 558. — Porcher, *Resources of Southern Fields and Forests*, 507.

[3] Kalm, *Travels*, English ed. iii. 173.

[4] Schoepf, *Mat. Med. Amer.* 143. — Rafinesque, *Med. Fl.* ii. 268. — Griffith, *Med. Bot.* 609. — Johnson, *Man. Med. Bot. N. Am.* 260. — *U. S. Dispens.* ed. 16, 1492.

[5] Hamilton, *Fl. Homœopathica*, ii. 202, t. 63. — Millspaugh, *Am. Med. Pl. in Homœopathic Remedies*, ii. 165, t. 165.

[6] *Arbor Vitæ*, Belon, *Arb. Conif.* 13. — Dodoens, *Hist. Stirp. Pemp.* 857, f. — Gerarde, *Herball*, 1186, f. — Clusius, *Hist. Pl.* i. 36. — Parkinson, *Theatr.* 1478, f.

Cedrus Lycia. Arbor vitæ, Lobel, *Stirp. Hist.* 630, f.

Arbor vitæ Gallis, Dalechamps, *Hist. Gen. Pl.* i. 60.

Thuya Theophrasti, C. Bauhin, *Pinax*, 488.

Arbor Vitae, sive Paradisiaca vulgò dicta, odorata ad Sabinam accedens, J. Bauhin, *Hist. Pl.* i. lib. ix. 286, f.

Thuja strobilis lævibus: squamis obtusis, Linnæus, *Hort. Cliff.* 449; *Hort. Ups.* 289. — Royen, *Fl. Leyd. Prodr.* 87.

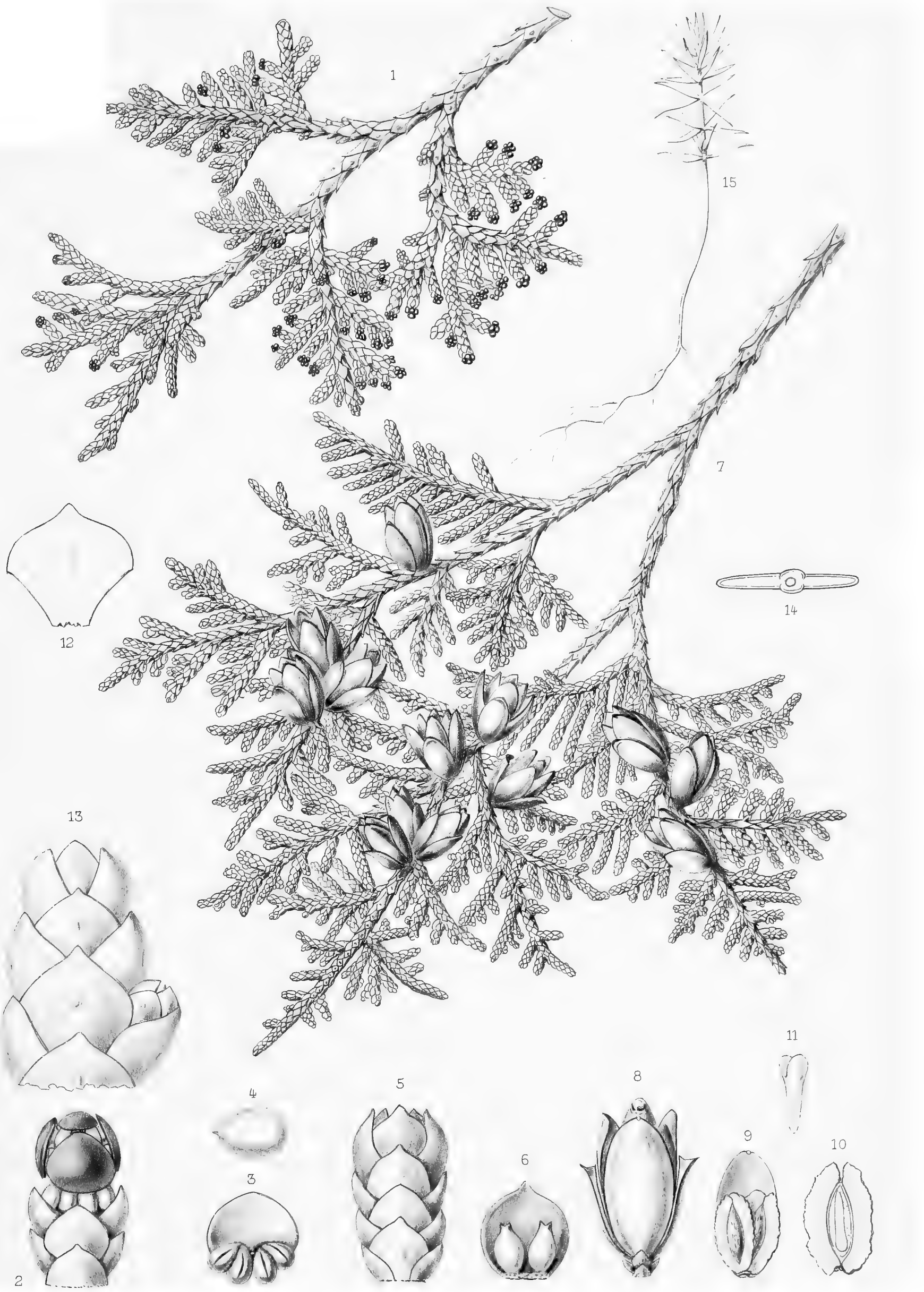
[7] Beissner (*Handb. Nadelh.* 32) enumerates forty varieties of *Thuya occidentalis*, and there are several others which are known only in American gardens. Many of them show their distinctive peculiarities only while young, and soon grow into the normal form, and to several originating independently in different nurseries more than one name has been given. Although interesting as showing the tendency of the tree to vary in cultivation, none of these forms equals in beauty the original type, which, stiff and formal in outline when planted as an isolated specimen on high ground, is admirably suited for massing on the borders of streams and lakes.

[8] Downing, *Landscape Gardening*, ed. H. W. Sargent, 267. — Warder, *Hedges and Evergreens*, 42, 260.

EXPLANATION OF THE PLATE.

PLATE DXXXII. THUYA OCCIDENTALIS.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A pollen-sac, enlarged.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower with its ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. A fruit, enlarged.
9. A scale of fruit with its seeds, front view, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A leaf, enlarged.
13. End of a branchlet, enlarged.
14. Cross section of a branchlet, enlarged.
15. A seedling, natural size.



C.E.Faxon del. Himely sc.

THUYA OCCIDENTALIS, L.

A.Riocreux direx.t Imp. J. Taneur, Paris.

THUYA GIGANTEA.

Red Cedar. Canoe Cedar.

FRUIT large, with usually 6 fertile scales. Wood dull red-brown.

Thuya gigantea, Nuttall, *Jour. Phil. Acad.* vii. pt. i. 52 (1834); *Sylva*, iii. 102, t. 91. — Hooker, *Fl. Bor.-Am.* ii. 165. — Spach, *Hist. Vég.* xi. 342. — Endlicher, *Syn. Conif.* 52. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 206. — Newberry, *Pacific R. R. Rep.* vi. pt. ii. 56, f. 22. — Carrière, *Traité Conif.* 105 (in part). — Gordon, *Pinetum*, 321 (in part); Suppl. 102. — Torrey, *Bot. Mex. Bound. Surv.* 211. — Cooper, *Pacific R. R. Rep.* xii. pt. ii. 69; *Am. Nat.* iii. 413. — Lyall, *Jour. Linn. Soc.* vii. 133, 144. — Henkel & Hochstetter, *Syn. Nadelh.* 280 (in part). — (Nelson) Senilis, *Pinaceæ*, 67. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 457. — R. Brown Campst. *Trans. Bot. Soc. Edinburgh*, ix. 367. — Hoopes, *Evergreens*, 315. — K. Koch, *Dendr.* ii. pt. ii. 176. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 115. — Veitch, *Man. Conif.* 256. — Regel, *Russ. Dendr.* ed. 2, i. 20. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 177. — Lauche, *Deutsche Dendr.* ed. 2, 68. — Mayr, *Wald. Nordam.* 319, f. 13, t. 6, f., t. 8, f. — Lemmon, *Rep. California State Board Forestry*, iii. 171, t. 20, 21 (*Cone-Bearers of California*). — Beissner, *Handb. Nadelh.* 46, f. 6, 7. — Masters, *Jour. R. Hort. Soc.* xiv. 251. — Hansen, *Jour. R. Hort. Soc.* xiv. 270 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 48.

Thuya Menziesii, Carrière, *Traité Conif.* 106 (1855). — Gordon, *Pinetum*, 323. — (Nelson) Senilis, *Pinaceæ*, 67. — Henkel & Hochstetter, *Syn. Nadelh.* 281.

Thuya plicata, Sudworth, *Rep. U. S. Dept. Agric.* 1892, 328 (probably not D. Don) (1893). — Lemmon, *West-American Cone-Bearers*, 72.

A tree, with short horizontal branches, usually pendulous at the extremities, which often clothe the stem nearly to the ground until it is sixty or seventy feet tall, frequently attaining a height of two hundred feet, with a broad buttressed base sometimes fifteen feet in diameter and tapering gradually until the trunk is not more than five or six feet thick at twelve or fifteen feet above the ground;[1] in old age the trunk often separates toward the summit into two or three erect divisions, and forms a dense narrow pyramidal spire, or, when the tree has been crowded in the forest, a short narrow crown. The bark of the trunk is bright cinnamon-red, from one half to three quarters of an inch in thickness, and irregularly divided by narrow shallow fissures into broad ridges rounded on the back and broken on the surface into long narrow rather loose plate-like fibrous scales. The branchlets are slender, much compressed, often slightly zigzag, light bright yellow-green during their first year, then cinnamon-brown, and when the leaves have fallen, usually in their third year, lustrous and dark reddish brown often tinged with purple; the lateral branchlets, which turn yellow and fall generally at the end of their second season, are often five or six inches in length, light yellow-green and lustrous on the upper surface, and somewhat paler on the lower. On leading shoots the leaves are ovate, long-pointed, often conspicuously glandular on the back, and frequently a quarter of an inch in length, and on the lateral branchlets they are ovate, apiculate, eglandular or obscurely glandular-pitted, and usually not more than an eighth of an inch long. The flowers are about one twelfth of an inch in length and dark brown. The fruit, which ripens early in the autumn, is clustered near the ends of the branches and much reflexed, and is half an inch long, with thin leathery scales conspicuously marked near the apex by the free border of the flower-scales, which are furnished with short stout erect or recurved dark mucros. The scales of two or of three of the central ranks bear seeds; there are often three in number under each scale, and rather shorter than their wings, which are nearly one quarter of an inch in length, and usually slightly unequal.

Thuya gigantea is widely and generally distributed, but nowhere forms pure forests, growing singly or in small groves generally on low moist bottom-lands or near the banks of mountain streams,

[1] *Garden and Forest*, iv. 109, f. 23.

and also, although less commonly, on dry ridges and mountain slopes, which in the interior it sometimes ascends to elevations of six thousand feet above the level of the sea. It is distributed from the coast region of southern Alaska,[1] where it is scattered through the forests of Spruce and Hemlock, southward along the coast ranges and islands of British Columbia, through western Washington and Oregon, where it is most abundant and grows to its largest size on low lands in the immediate neighborhood of the coast associated with the Tide-water Spruce, and through the California coast region, where its ordinary companions are the Redwood, the Douglas Fir, and the White Fir, to Mendocino County; it spreads eastward along many of the interior ranges of British Columbia to the western slope of the continental divide, which, as a low shrub, it sometimes ascends to elevations of six thousand feet,[2] and along those of northern Washington and the Cœur d'Alêne, Bitter Root, and Salmon River Mountains of Idaho, to the western slopes of the Rocky Mountains of northern Montana, where it rarely descends below elevations of five thousand feet.

The wood of *Thuya gigantea* is very light, soft, not strong, brittle, rather coarse-grained, easily split, and very durable in contact with the soil;[3] it is dull brown tinged with red, with thin nearly white sapwood, and contains thin dark-colored distinct bands of small summer-cells and numerous obscure medullary rays. The specific gravity of the absolutely dry wood is 0.3796, a cubic foot weighing 23.66 pounds. It is largely used in Washington and Oregon for the interior finish of buildings, for doors, sashes, fences, and shingles, and in cabinet-making and cooperage. From the trunks of this tree the Indians of the northwest coast split the planks used in the construction of their lodges, carved the totems which decorated their villages, and hollowed out their great war canoes. From the fibres of the inner bark they made ropes, blankets and cloaks, and the thatch for their cabins.[4]

Thuya gigantea was discovered by Menzies, the surgeon and naturalist of Vancouver in 1796.[5] It was not described until many years later, when it was found by Douglas on the lower Columbia River. Introduced into English gardens about half a century ago, *Thuya gigantea*[6] has proved hardy in western and central Europe, where it has already attained a large size;[7] and occasionally cultivated in the middle and northern United States, it survives the winters of eastern Massachusetts.

The noblest of its race and one of the most valuable timber-trees of northwestern America, *Thuya gigantea* is rapidly disappearing with the spread of forest fires, which, burning through their thin bark, soon kill these trees.

[1] Meehan, *Proc. Phil. Acad.* 1884, 93. — F. Kurtz, *Bot. Jahrb.* xix. 424 (*Fl. Chilcatgebietes*).

[2] J. M. Dawson, *Can. Nat.* n. ser. ix. 324. — Macoun, *Cat. Can. Pl.* 460.

[3] The durability of the wood of *Thuya gigantea* is shown by the sound condition of logs which must have lain on the ground for more than a century, as other trees sprung from seed deposited upon them after they had fallen have in one recorded instance attained a trunk diameter of from three to four feet; and near the shores of Shoal Water Bay, Washington, submerged by the gradual sinking of the land, the trunks of Thuya long stood erect as the last witnesses to the fact that forests had once covered the spot. (See Cooper, *Pacific R. R. Rep.* xii. pt. ii. 25.)

[4] R. Brown Campst. *Trans. Bot. Soc. Edinburgh*, ix. 369.

[5] A small compact Thuya, regular in outline, and said to have been discovered by Menzies on Vancouver's Island in 1796, as well as several forms raised in gardens, has long been cultivated in Europe under the name of *Thuya plicata* (D. Don, *Cat. Hort. Cantab.* ed. 6, 249 [1811]. — Lambert, *Pinus*, ii. 19. — Spach, *Hist. Vég.* xi. 342. — Endlicher, *Syn. Conif.* 51. — Carrière, *Traité Conif.* 102. — Henkel & Hochstetter, *Syn. Nadelh.* 277. — Gordon, *Pinetum*, ed. 2, 406. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 457. — Beissner, *Handb. Nadelh.* 44). There is great uncertainty in regard to the true character of the plant originally described by Don, but most of the individuals now cultivated under this name are forms of *Thuya occidentalis*, although *Thuya gigantea* is also occasionally cultivated as *Thuya plicata*. No tree resembling the *Thuya plicata* of gardens has been found in northwestern America, and this plant, like most of its varieties, is best considered a garden form referable to *Thuya occidentalis* rather than to *Thuya gigantea*.

[6] In English gardens *Thuya gigantea* is frequently cultivated as *Thuya Lobbii* and as *Thuya Lobbiana;* and in most European gardens the names of *Thuya gigantea* and of *Libocedrus decurrens* have been exchanged through a mistake in identification made by one of the early collectors of the seeds of these trees. (See R. Brown Campst. *Gard. Chron.* 1873, 8.) Forms slightly differing in habit and in the color of the branchlets are occasionally cultivated in European collections. (See Beissner, *l. c.* 48.)

[7] Fowler, *Gard. Chron.* 1872, 1527. — Webster, *Trans. Scottish Arboricultural Soc.* xi. 66 (*Thuja Lobbii*). — R. Hartig, *Forst.-Nat. Zeit.* 1892, 28.

EXPLANATION OF THE PLATE.

PLATE DXXXIII. THUYA GIGANTEA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, front view, enlarged.
4. A stamen, rear view, enlarged.
5. A pistillate flower, enlarged.
6. A scale of a pistillate flower with its ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. A scale of a fruit, front view, enlarged.
9. Vertical section of a seed, enlarged.
10. An embryo, enlarged.
11. End of a branchlet, enlarged.
12. Seedlings, natural size.

C.E. Faxon del. *Himely sc.*

THUYA GIGANTEA, Nutt.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

LIBOCEDRUS.

Flowers naked, monœcious or diœcious, terminal, solitary; stamens numerous, in many ranks, decussately opposite; anther-cells usually 4; scales of the pistillate flower 4 or 6, acuminate; ovules 2. Fruit a strobile maturing in one season. Leaves dimorphic, persistent.

Libocedrus, Endlicher, *Syn. Conif.* 42 (1847); *Gen.* Suppl. iv. pt. ii. 3. — Bentham & Hooker, *Gen.* iii. 426. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 95. — Masters, *Jour. Linn. Soc.* xxx. 19.

Heyderia, K. Koch, *Dendr.* ii. pt. ii. 177 (1873).

Calocedrus, Kurz, *Jour. Bot.* xi. 196 (1873).

Thuya, Baillon, *Hist. Pl.* xii. 34 (in part) (not Linnæus) (1892).

Resinous aromatic trees, with scaly bark, soft straight-grained durable fragrant wood, spreading branches, flattened branchlets disposed in one horizontal plane forming an open distichous spray, and often ultimately deciduous, naked buds, and fibrous roots. Leaves scale-like, opposite, imbricated in four ranks, glandular or eglandular on the back, entire with thin cartilaginous margins, persistent; on leading shoots nearly equally decussate, closely appressed or spreading, often remote by the lengthening of the nodes, dying and becoming woody before falling; on lateral flattened branchlets those of the lateral ranks much compressed, conspicuously carinate and nearly covering those of the other ranks; on seedling plants linear-lanceolate and spreading. Flowers appearing in winter or very early spring from buds formed the previous autumn, monœcious, with those of the two sexes on different branchlets or diœcious, solitary, terminal. Staminate flower subsessile, globose or ovoid; stamens from twelve to sixteen, decussately opposite on a slender axis; filaments short, dilated into scale-like broadly ovate or orbicular eccentrically peltate connectives bearing usually four subglobose two-valved anther-cells opening on the back; pollen-grains simple. Pistillate flower subglobose, ovoid or oblong, terminal on a short lateral branchlet, often subtended by several pairs of leaf-like scales slightly enlarged and persistent under the fruit, composed of four or rarely of six decussately opposite scales, acuminate with long or short points; scales of the upper or of the middle rank much longer than those of the lower rank, ovate or oblong, fertile, bearing at the base on a minute accrescent ovuliferous scale two erect collateral orthotropous ovules. Fruit maturing in one season, ovoid or oblong, surrounded at the base by the somewhat enlarged upper leaves of the branchlet, persistent after the discharge of the seeds until the following season, its scales subcoriaceous, marked at the apex by the free slightly thickened mucronulate border of the enlarged flower-scale; the lowest pair thin, ovate, reflexed, much shorter than the oblong or ovate thickened woody scales of the second rank widely spreading at maturity; those of the third rank, when present, confluent into an erect woody septum. Seeds in pairs or solitary by abortion, erect, oblong-lanceolate, compressed; testa coriaceous, produced into lateral membranaceous wings, the one narrow, the other broad, oblique and nearly as long as the scale, free, or united, with a conspicuous suture; embryo axile in fleshy albumen; cotyledons two, radicle cylindrical, superior.

Eight species of Libocedrus, which is perhaps too closely connected with Thuya to be considered generically distinct, are now distinguished; one is widely scattered through the mountain forests of western North America; two inhabit western South America, where they are distributed from Chili to Patagonia; two occur in New Zealand, two in New Caledonia,[1] and one in southwestern

[1] *Libocedrus austro-caledonica,* Brongniart & Gris, *Bull. Soc. Bot. France,* xviii. 140 (1871), and

Libocedrus Papuana, F. Mueller, *Trans. R. Soc. Victoria,* i. pt. ii. 32 (*Records of Observations on Sir W. McGregor's Highland-Plants from New Guinea*) (1889). — Beissner, *Handb. Nadelh.* 31.

China.[1] Species of Libocedrus analogous to those now existing in South America inhabited Greenland during the cretaceous period and then spread over Europe, well-defined traces of their existence in tertiary times appearing in the miocene rocks of Spitzenbergen and in central Europe, and in amber deposits.[2]

Libocedrus produces durable wood used in construction and for many rural purposes, the most valuable timber-trees of the genus being the South American *Libocedrus cupressoides*,[3] the New Zealand *Libocedrus Bidwillii*[4] and *Libocedrus plumosa*,[5] the North American *Libocedrus decurrens*, and the Chilian *Libocedrus Chilensis*.[6]

The North American Libocedrus is not known to suffer from insect enemies, but its value as a timber-tree is seriously impaired by fungal disease.[7]

The species of Libocedrus can be propagated by seeds and by cuttings made from branches of the year.

The generic name, from λιβάς and *Cedrus*, relates to the resinous character of these trees.

[1] *Libocedrus macrolepis*, Bentham & Hooker, *Gen.* iii. 426 (1880). — Beissner, *Handb. Nadelh.* 30.

Calocedrus macrolepis, Kurz, *Jour. Bot.* xi. 196, t. 133 (1873).

[2] Saporta, *Origine Paléontologique des Arbres*, 97. — Zittel, *Handb. Palæontolog.* ii. 315.

[3] *Libocedrus cupressoides.*

Pinus cupressoides, Molina, *Saggio sulla storia naturale del Chile*, 168 (1782).

Thuya tetragona, Hooker, *Lond. Jour. Bot.* iii. 148, t. 4 (1844).

Libocedrus tetragona, Endlicher, *Syn. Conif.* 44 (1847). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 454.

Libocedrus cupressoides, the Alerse of Chili, which in the sheltered ravines of the Valdivian Andes is a tree from eighty to one hundred feet high, with a trunk occasionally ten feet in diameter, and at high elevations and on the shores of the Straits of Magellan a low much-branched bush, is distributed from southern Chili to Patagonia. The soft straight-grained wood is easily split and worked, and is almost indestructible by the action of weather. The trunks of the Alerse are used for the masts and spars of vessels, and are often manufactured into shingles and lumber employed for fencing and in construction of all sorts. The inner bark, which is imperishable in water, is used to calk the seams of boats and small vessels. (See P. Parker King, *Narrative of the Surveying Voyage of His Majesty's Ships Adventure and Beagle*, i. 282. — C. Gay, *Fl. Chil.* v. 407.)

[4] Hooker f. *Fl. New Zeal.* i. 257 (1867).

Libocedrus Bidwillii is a tree from fifty to eighty feet in height, with a trunk sometimes three feet in diameter, which is widely scattered through the mountain forests of New Zealand, sometimes ascending on the west coast of the Southern Island to elevations of nearly four thousand feet. The wood is red, straight-grained, light and brittle, but extremely durable ; in New Zealand it is used in construction and for piles, the posts and rails of fences, railway-ties, telegraph-poles, shingles, and weather-boards. (See Kirk, *Forest Fl. New Zeal.* 159, t. 82ᵃ, f. 2, 83.)

[5] *Libocedrus plumosa.*

Dacrydium plumosum, D. Don, *Lambert Pinus*, ed. 2, ii. Appx. 143 (1828). — A. Cunningham, *Ann. Nat. Hist.* i. 213.

Thuya Doniana, Hooker, *Lond. Jour. Bot.* i. 571, t. 18 (1842). — Hooker f. *l. c.* 231.

Libocedrus Doniana, Endlicher, *Syn. Conif.* 43. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 454.

Libocedrus plumosa, a comparatively rare tree and confined to the Northern Island, is distinguished while young by its much flattened crowded branchlets giving a plume-like appearance to the branches, and is often one hundred feet high, with a straight naked trunk four or five feet in diameter, covered with the long ribbon-like loose scales of the reddish bark. The wood is light, strong, very durable, straight-grained, and dark red handsomely marked with darker stripes ; it is used in fencing, in construction, and for shingles, and is highly esteemed for cabinet-making and the interior finish of houses. (See Kirk, *l. c.* 158, t. 82, 82ᵃ, f. 1.)

[6] Endlicher, *Syn. Conif.* 44 (1847). — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 455.

Thuya Chilensis, D. Don, *Lambert Pinus*, ii. 19 (1824). — Hooker, *Lond. Jour. Bot.* ii. 199, t. 4.

Thuya Andina, Poeppig & Endlicher, *Nov. Gen. et Spec.* iii. 17 t. 220 (1845).

Libocedrus Chilensis is a tree fifty or sixty feet in height, with a short trunk frequently branched from the base and a compact symmetrical pyramidal head, growing on the lower slopes of the Andes of southern Chili from latitude 34° south to Valdivia. The soft straight-grained red wood is largely used in Chili in the interior finish of houses. (See C. Gay, *l. c.* 406.)

[7] The trunks of *Libocedrus decurrens* are frequently honeycombed and its value as a timber-tree destroyed by *Dœdalea vorax* (Harkness, *Pacific Rural Press*, Jan. 25, 1879), which destroys rounded masses of the wood, disposed in long rows sometimes extending through the length of the trunk, reducing them to cinder-like powder. It is also said to be attacked by *Gymnosporangium biseptatum*, Ellis, which in the eastern states lives upon *Cupressus thyoides*, and by a few other unimportant fungi.

LIBOCEDRUS DECURRENS.

White Cedar. Incense Cedar.

FRUIT pendulous, composed of six scales; seeds two under each fertile scale.

Libocedrus decurrens, Torrey, *Smithsonian Contrib.* vi. 7, t. 3 (*Pl. Frémont.*) (1854); *Pacific R. R. Rep.* iv. pt. v. 140; *Bot. Mex. Bound. Surv.* ii. 211. — Lindley, *Gard. Chron.* 1853, 695. — Bentham, *Pl. Hartweg.* 338. — Newberry, *Pacific R. R. Rep.* vi. pt. iii. 63. — Walpers, *Ann.* v. 795. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 456. — R. Brown Campst. *Trans. Bot. Soc. Edinburgh*, ix. 373. — A. Murray, *The Garden*, ii. 540, f. — Hoopes, *Evergreens*, 309, f. 40. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 116. — Gordon, *Pinetum*, ed. 2, 181. — Veitch, *Man. Conif.* 267. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 176. — Lemmon, *Rep. California State Board Forestry*, iii. 173, t. 22, 23 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 73. — Beissner, *Handb. Nadelh.* 28, f. 1, 2. — Masters, *Jour. R. Hort. Soc.* xiv. 219. — Hansen, *Jour. R. Hort. Soc.* xiv. 268 (*Pinetum Danicum*). — Merriam, *North American Fauna*, No. 7, 340. — Coville, *Contrib. U. S. Nat. Herb.* iv. 224 (*Bot. Death Valley Exped.*).

Thuya Craigana, A. Murray, *Rep. Oregon Exped.* 2, t. 5 (October, 1854).

Thuya gigantea, Carrière, *Rev. Hort.* 1854, 224, f. 12, 14 (in part) (not Nuttall); *Flore des Serres*, ix. 199, f. 3–5 (in part); *Traité Conif.* 105 (in part). — Gordon, *Pinetum*, 321 (in part); Suppl. 102 (in part). — Henkel & Hochstetter, *Syn. Nadelh.* 280 (in part).

Heyderia decurrens, K. Koch, *Dendr.* pt. ii. 179 (1873). — Lauche, *Deutsche Dendr.* ed. 2, 70, f. 9.

A tree, frequently one hundred and fifty feet in height, with a tall straight slightly and irregularly lobed trunk tapering gradually from a broad base and sometimes seven or eight feet in diameter; during its first century the slender branches are erect at the top of the tree and below sweep downward in bold curves, forming a narrow open feathery crown, but in old age it becomes irregular in outline by the greater development of a few branches which, at first horizontal, soon turn upward and form secondary stems. The bark of the trunk is from one half of an inch to nearly an inch in thickness, bright cinnamon-red, and broken into irregular ridges covered with closely appressed plate-like scales. The leading branchlets are rather stout, and when they first appear are somewhat flattened and light yellow-green, turning light red-brown during the summer and ultimately brown more or less tinged with purple, and bearing for many years the nodal leaves or their narrow ring-like scars; the lateral branchlets are much flattened, and form an open pale yellow spray from four to six inches in length and usually deciduous at the end of the second or third season. The leaves are decussately opposite, with two pairs at each joint, and are oblong-obovate, decurrent and closely adnate on the branchlet except at the free callous apex, and from one eighth of an inch in length on the ultimate lateral branchlets to nearly one half of an inch on leading shoots, those of the lateral ranks being gradually narrowed and acuminate at the apex, and keeled and glandular on the back, and nearly covering those of the inner ranks, which are flattened, obscurely glandular-pitted, and abruptly pointed; on young seedlings the leaves are linear-lanceolate, acuminate, conspicuously ribbed, from one quarter to one half of an inch long, spreading and light yellow-green; and on the earliest flattened branchlets they are elongated and spreading. The flowers appear in January on the ends of short lateral branchlets of the previous year, the staminate, which are produced in great numbers, tingeing the tree with gold during the winter and early spring. The staminate flower is ovate, nearly a quarter of an inch long, and composed of from twelve to sixteen stamens with nearly orbicular or broadly ovate connectives rounded, acute, or acuminate at the apex and slightly erose on the margins. The pistillate flower is subtended by from two to six pairs of leaf-like scales slightly enlarged and persistent under the fruit, and is about an eighth of an inch in length, with six ovate acute light yellow-green slightly spreading scales, those of the second rank bearing two pale yellow ovules. The fruit ripens and discharges its seeds in

the autumn, but does not fall until the following spring or summer; it is oblong, more or less gibbous at the base, from three quarters of an inch to an inch in length, pendulous, light red-brown, and composed of six scales mucronulate below the apex; those of the lowest rank are thin, broadly ovate, much recurved, and rather less than a quarter of an inch in length; those of the second rank are ovate-oblong, thick and woody in texture, nearly as long as the fruit, and often a third of an inch in width, wide-spreading at maturity from the thick erect woody septum formed by the union of the upper scales and marked at the base on the inner surface with two oblong collateral depressions caused by the growth of the seeds; these are two in number under each of the two middle scales, and are oblong-lanceolate, from one third to one half of an inch in length, semiterete and marked below by conspicuous pale basal hilums extending up both sides of the seed to above the middle; the seed-coat is membranaceous, of two layers, the inner being penetrated by large elongated resin-chambers filled with red liquid balsamic resin, and the outer produced into a light red-brown membranaceous very oblique wing as long as the scale of the fruit and marked by a dark longitudinal suture.

Libocedrus decurrens is distributed from the basin of the North Fork of the Santiam River in Oregon southward along the western slopes of the Cascade Mountains and the California Sierra Nevada, and along the California coast ranges from the southern borders of Mendocino County to the San Bernardino, San Jacinto, and Cuayamaca Mountains, finding its most southern home on the high Mount San Pedro Martir, half way down the peninsula of lower California,[1] and occasionally crossing the Sierra Nevada of central California to western Nevada.[2] Although widely scattered and not rare, it usually grows singly or in small isolated groves and does not form forests. It is comparatively rare in Oregon, where it ascends to altitudes of about five thousand feet, and also in the California coast ranges, growing on the San Jacinto and San Bernardino Mountains at elevations of from five to seven thousand feet;[3] it is most abundant and attains its greatest size on the western slopes of the Sierras of central California, where it thrives in all sorts of soils at elevations of from three to five thousand feet. Although able to support more moisture at the roots than most of the other California conifers,[4] it attains its greatest perfection on warm dry hillsides, on plateaus, and on the floors of open valleys, where, mingled with the Yellow Pine and the Black Oak, it is a magnificent feature of the forest, with its symmetrical crown of graceful yellow-green branchlets and its bright red-brown bark.

Although often injured by dry rot, *Libocedrus decurrens* when in a healthy condition is one of the most valuable timber-trees of western North America. The wood is light, soft, close-grained, and very durable in contact with the soil, but not strong; it contains thin dark-colored conspicuous bands of small summer-cells and numerous obscure medullary rays, and is light reddish brown, with thin nearly white sapwood. The specific gravity of the absolutely dry wood is 0.4017, a cubic foot weighing 25.03 pounds. It is largely used for fencing, for laths and shingles, for the interior finish of buildings and for furniture, and in the construction of flumes. The bark is rich in tannin.[5]

Libocedrus decurrens[6] was discovered by Frémont on the upper waters of the Sacramento River in 1846, and appears to have been first cultivated in 1853 at Edinburgh. It is now a common inhabitant of the parks and gardens of western and central Europe, where it grows rapidly and promises to attain a large size; it is also occasionally cultivated in the eastern United States, growing luxuriantly in the neighborhood of the city of Washington, and proving precariously hardy as far north as the valley of the lower Hudson River. Forms of *Libocedrus decurrens* of abnormal habit and with glaucous foliage which have originated in European gardens are occasionally cultivated.[7]

[1] Brandegee, *Zoë*. iv. 210.

[2] Watson, *King's Rep.* v. 335.

[3] S. B. Parish, *Zoë*, iv. 352.

[4] Muir, *Mountains of California*, 169, f.

[5] Trimble, *Garden and Forest*, ix. 162.

[6] In California *Libocedrus decurrens* is sometimes also called Bastard Cedar and Post Cedar.

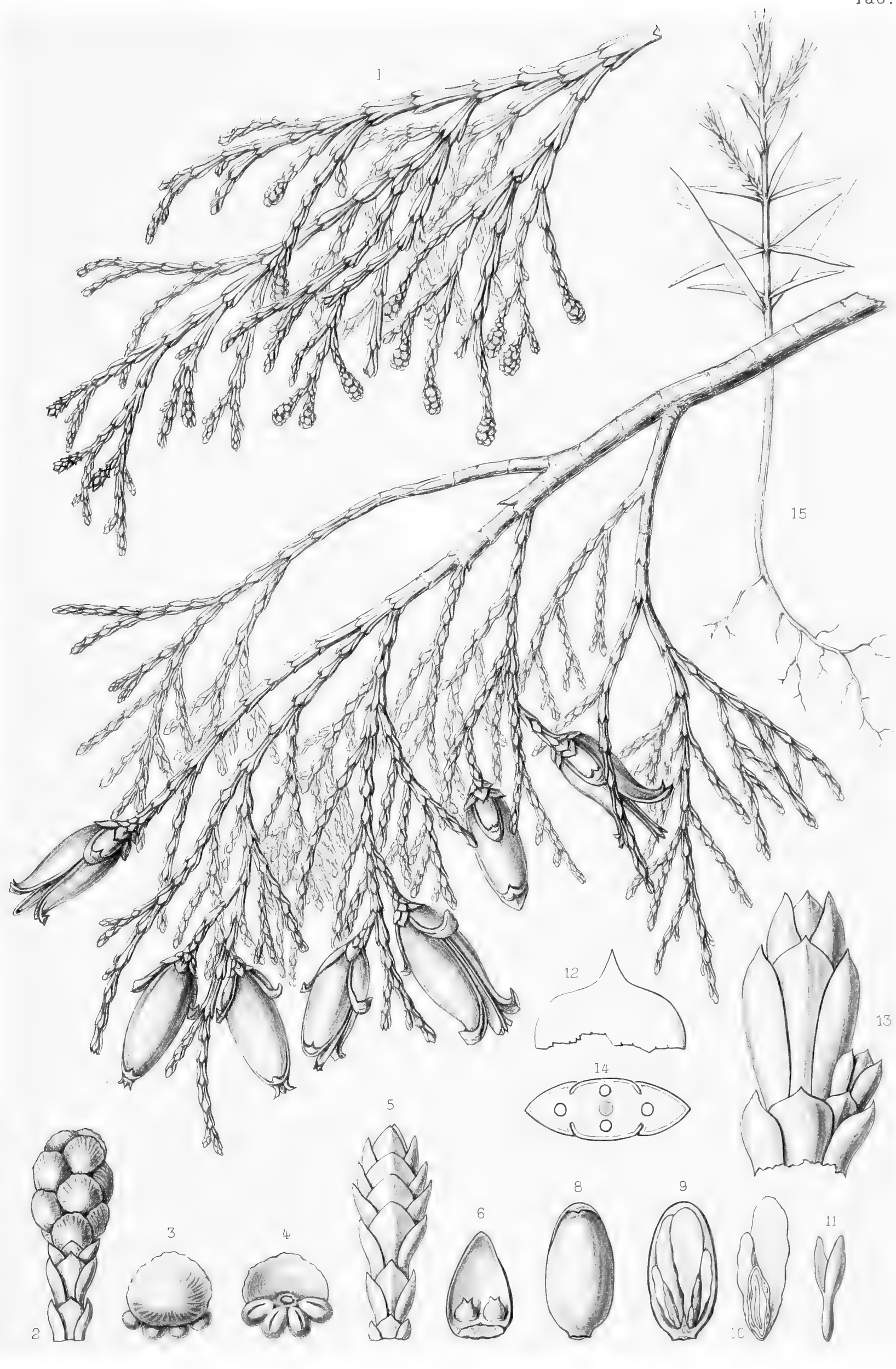
[7] Beissner, *Handb. Nadelh.* 30.

In European gardens *Libocedrus decurrens* is still frequently cultivated as *Thuya gigantea*. (See R. Brown Campst. *Gard. Chron.* 1873, 8.)

EXPLANATION OF THE PLATE.

PLATE DXXXIV. LIBOCEDRUS DECURRENS.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, rear view, enlarged.
4. A stamen, front view, enlarged.
5. A pistillate flower, enlarged.
6. A fertile scale of a pistillate flower with its ovules, front view, enlarged.
7. A fruiting branch, natural size.
8. A scale of a fruit, rear view, enlarged.
9. A scale of a fruit with its seeds, front view, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A leaf, enlarged.
13. End of a branchlet, enlarged.
14. Vertical section of a branchlet, enlarged.
15. A seedling, natural size.



C.E.Faxon del.

Rapine sc.

LIBOCEDRUS DECURRENS, Torr.

A.Riocreux dirext.

Imp. J.Taneur, Paris.

SEQUOIA.

FLOWERS naked, monœcious, solitary, the staminate terminal or axillary; stamens numerous; anther-cells 2 to 5; the pistillate terminal; scales numerous, bearing 3 to 7 ovules. Fruit a woody strobile. Leaves alternate, often dimorphic, persistent.

Sequoia, Endlicher, *Syn. Conif.* 197 (1847); *Gen.* Suppl. iv. pt. ii. 7. — Bentham & Hooker, *Gen.* iii. 429. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 85. — Masters, *Jour. Linn. Soc.* xxx. 22.

Wellingtonia, Lindley, *Gard. Chron.* 1853, 823.

Gigantabies (Nelson), Senilis, *Pinaceæ*, 77 (1866).

Athrotaxis, Baillon, *Hist. Pl.* xii. 39 (in part) (not G. Don) (1892).

Resinous aromatic trees, with tall massive lobed trunks, thick bark of two layers, the outer deeply lobed and composed of fibrous scales, the inner close and firm and from half an inch to an inch in thickness, soft durable straight-grained dark red heartwood, thin nearly white sapwood, stout short horizontal branches, slender terete branchlets deciduous in the autumn, scaly or naked buds, and fibrous roots. Leaves ovate-lanceolate or linear and distichously spreading, especially on young trees and branches, or linear, acute, compressed and keeled on the back, closely appressed or spreading at the apex, the two forms sometimes appearing on the same branch or on different branches of the same tree. Flowers minute, solitary, monœcious, appearing in early spring from buds formed the previous autumn. Staminate flowers terminal or in the axils of upper leaves, ovoid or oblong, stipitate, subtended by numerous decussately imbricated scale-like bracts, their axes bearing in many series numerous spirally disposed spreading stamens; filaments short, dilated into ovate acute subpeltate connectives incurved at the apex, often denticulate on the margins, bearing on their inner face at the base from two to five but usually three pendulous globose two-valved anther-cells opening below dorsally; pollen-grains simple. Pistillate flower terminal, ovoid or oblong, composed of numerous ovate scales bluntly keeled on the back, the keels produced into short or elongated points, spirally imbricated in numerous series, closely adnate to the thick fleshy much shorter ovuliferous scales rounded above and bearing below their upper margin in two rows from five to seven free orthotropous bottle-shaped ovules erect at first but afterward horizontal and finally reversed. Fruit an ovoid or shortly oblong pendulous strobile, maturing during its first season, persistent after the opening of the scales and the discharge of the seeds; its scales, formed by the enlargement of the united flower and ovuliferous scales, indurate and woody, contracted at the base into slender stipes or gradually enlarged upward, widened at the apex into narrow thickened transverse oblong rugose disks, transversely depressed through the middle, and often mucronulate. Seeds from five to seven under each scale, reversed and pendulous, oblong-ovate, compressed; testa membranaceous or slightly crustaceous, produced into broad thin wings. Embryo axile, straight in copious fleshy albumen; cotyledons from four to six, longer than the inferior radicle, turned away from the small depressed pale hilum.

Sequoia, which inhabited the Arctic Circle during the cretaceous and tertiary epochs, and was then a conspicuous feature of the vegetation of Europe and of the interior regions of North America, where several species existed,[1] is now confined to the mountain forests of California, and reduced to two species, one inhabiting the northern and central coast ranges, and the other the western slopes of the Sierra Nevada.

[1] Gray, *Proc. Am. Assoc. Adv. Sci.* xxi. 1 (*Sequoia and its History*); *Scientific Papers*, ii. 142. — Lesquereux, *Rep. U. S. Geolog. Surv.* vii. 75, t. 7, f. 3–16ᵃ; t. 65, f. 1–4; t. 61, f. 25–29; t. 62, f. 15–18ᵃ. — Saporta, *Origine Paléontologique des Arbres*, 89. — Zittel, *Handb. Palæontolog.* ii. 296, f. 205.

The trunks of Sequoia are largely manufactured into lumber used in construction and the interior finish of houses, and for fencing and railway-ties.

Comparatively few insects[1] prey upon Sequoia, which is free from serious fungal diseases.[2]

Sequoia can be easily raised from seeds, which germinate usually at the end of a few weeks.

The name of the genus immortalizes Sequoyah,[3] the inventor of the Cherokee alphabet.

[1] Little is known of the insects which attack Sequoia. The most destructive is *Bembecia Sequoiæ*, Henry Edwards, which, it is said, "is devastating the Pine forests of Mendocino County, California, and is particularly destructive to *Sequoia sempervirens*, *Pinus ponderosa* and *Pinus Lambertiana*. The eggs appear to be laid in the axils of the branches, the young caterpillar boring in a tortuous manner about its retreat, thus diverting the flow of sap, and causing large resinous nodules to form at the place of its workings. These gradually harden, the branch beyond them dies, and the tree at last succumbs to its insignificant enemies. Hundreds of fine trees in the forests of the region indicated are to be seen in various stages of decay." (*Bull.* No. 7, *U. S. Dept. of the Interior*, 1881, 261 [*Insects Injurious to Forest and Shade Trees*].)

[2] Both the species of Sequoia are infested by a number of small characteristic fungi, although none of them are known to cause serious diseases. More than thirty species have been recorded on *Sequoia sempervirens* and about ten on *Sequoia Wellingtonia*. Among the latter may be mentioned *Scleroderris Sequoiæ*, Saccardo, which occurs on the trunks, and *Lachnea Sequoiæ*, Saccardo, and *Læstadia consociata*, Cooke, on the leaves. *Sequoia sempervirens* is attacked by such widely spread species as *Hypocrea rufa*, Fries, *Pitya Cupressi*, Saccardo, *Stictis versicolor*, Fries, and by special parasites like *Amphisphæria Wellingtoniæ*, Berlese & Voglino, *Leptostroma Sequoiæ*, Cooke & Harkness, *Melanopsamma confertissima*, Saccardo, and other small species not found upon other hosts. Young plants of *Sequoia Wellingtonia* cultivated in Europe are said to suffer from attacks of a species of Botrytis, and a species of the same genus has been reported on wild trees in this country, although it is not known whether or not the same species attacks these trees in California and Europe.

[3] George Guess or Sequoyah (about 1770–August, 1843), a Cherokee half-breed, was first known as a small farmer in the Cherokee country of Georgia, and as a skillful silversmith. In 1826 he published his syllabic Cherokee alphabet of eighty-five characters, each representing a single sound, which was afterward used in printing *The Cherokee Phœnix*, a journal devoted to the interests of the Cherokee nation, and a portion of the New Testament. Guess moved with his tribe to the Indian Territory, and died in San Fernando in northern Mexico.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Scales of the pistillate flower usually about 20, long or short-pointed; leaves dimorphic, mostly distichously spreading, acute or acuminate; buds scaly	1. SEQUOIA SEMPERVIRENS.
Scales of the pistillate flower usually from 25–30, long-pointed; leaves ovate, acute, or lanceolate, slightly spreading or appressed; buds naked	2. SEQUOIA WELLINGTONIA.

SEQUOIA SEMPERVIRENS.

Redwood.

Scales of the pistillate flower usually about 20. Cone-scales abruptly enlarged into the terminal discs. Leaves dimorphic, mostly distichously spreading, acute or acuminate. Buds scaly.

Sequoia sempervirens, Endlicher, *Syn. Conif.* 198 (1847). — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 222. — Decaisne, *Rev. Hort.* 1859, 9, f. 2. — Carrière, *Traité Conif.* 164. — J. M. Bigelow, *Pacific R. R. Rep.* iv. pt. v. 23. — Torrey, *Pacific R. R. Rep.* iv. pt. v. 140; *Bot. Mex. Bound. Surv.* 210; *Ives' Rep.* 28. — Newberry, *Pacific R. R. Rep.* vi. pt. iii. 57, 90, f. 23. — Gordon, *Pinetum*, 303. — A. Murray, *Edinburgh New Phil. Jour.* n. ser. xi. 221; *Trans. Bot. Soc. Edinburgh*, vi. 346. — Seemann, *Ann. and Mag. Nat. Hist.* ser. 3, iii. 165. — Hoopes, *Evergreens*, 244. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 436. — K. Koch, *Dendr.* ii. pt. ii. 193. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 116. — Veitch, *Man. Conif.* 212. — Lawson, *Pinetum Brit.* iii. t. 52, f. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 184. — Lauche, *Deutsche Dendr.* ed. 2, 79. — Lemmon, *Rep. California State Board Forestry*, iii. 163, t. 18 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 68. — Masters, *Jour. R. Hort. Soc.* xiv. 247; *Gard. Chron.* ser. 3, xix. 556, f. 86. — Hansen, *Jour. R. Hort. Soc.* xiv. 309 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 44, f. 14, A–G.

Taxodium sempervirens, Lambert, *Pinus*, ii. 24, t. 7 (1824). — Loudon, *Arb. Brit.* iv. 2487, f. 2340, 2341. — Hooker, *Fl. Bor.-Am.* ii. 164; *Icon.* iv. t. 379. — Hooker & Arnott, *Bot. Voy. Beechey*, 392. — Henkel & Hochstetter, *Syn. Nadelh.* 262.

Abies religiosa, Hooker & Arnott, *Bot. Voy. Beechey*, 160 (not Lindley) (1841).

Schubertia sempervirens, Spach, *Hist. Vég.* xi. 353 (1842).

Sequoia gigantea, Endlicher, *Syn. Conif.* 198 (1847). — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 222. — Bentham, *Pl. Hartweg.* 338.

Sequoia religiosa, Presl, *Epimel. Bot.* 237 (1849). — Walpers, *Ann.* iii. 448.

Gigantabies taxifolia, (Nelson) Senilis, *Pinaceæ*, 78 (1866).

A tree, from two to three hundred feet in height, with a slightly tapering and irregularly lobed trunk, usually free of branches for seventy-five or one hundred feet, and from ten to fifteen or rarely from twenty to twenty-eight feet in diameter at the much buttressed base, and three hundred and fifty[1] feet tall, throwing up from the stump when cut and from fallen stems many vigorous long-lived shoots. On young trees the slender branches are erect above, and below sweep downward in graceful curves, forming an open slender pyramid of distichous flat spray, but long before the tree attains its full size the lower branches disappear, and those toward the summit become stout and horizontal, and the narrow rather compact and very irregular head is remarkably small in proportion to the height and size of the trunk. The bark of the trunk, which is from six to twelve inches in thickness, is divided into rounded ridges corresponding to the ridges of the trunk and frequently two or three feet wide, and separates on the surface into long narrow dark brown fibrous scales, often broken transversely, and disclosing in falling the bright cinnamon-red inner bark. The branchlets are slender and distichously spreading, and when they first appear are light yellow-green like the young leaves, but soon become dark green, and during their third or fourth season are covered with thin cinnamon-brown bark which breaks irregularly into loose papery scales. The buds are about one eighth of an inch in length, and are covered with many loosely imbricated ovate acute scales, prominently keeled on the back, slightly accrescent and persistent on the base of the branchlet. The leaves, which are persistent for two or three years, on the lateral branchlets of lower branches and of young trees are lanceolate, more or less falcate, acute or acuminate and usually tipped with slender rigid points, decurrent at the base, distichous and spreading at right angles to the branchlet by a half-turn at the base, from one

[1] The Redwood, which is the tallest American tree, probably occasionally attains the height of four hundred feet or more. The tallest specimen I have measured was three hundred and forty feet high.

quarter to one half of an inch in length, about one eighth of an inch in width, obscurely keeled, and marked above with two narrow longitudinal bands of stomata, and glaucous and stomatiferous below, with slightly thickened revolute margins and conspicuous midribs; on leading shoots they are disposed in many ranks, frequently scale-like, more or less spreading or appressed, ovate or ovate-oblong, incurved at the rounded apiculate apex, thickened, rounded and stomatiferous on the lower surface, concave, prominently keeled and covered with stomata on the upper surface, and usually about a quarter of an inch long, and die and turn red-brown at least two years before falling. Such scale-like leaves often occur on isolated branchlets among those bearing leaves of the normal form, and frequently cover entire branches, especially the upper branches of large trees, or rarely all the branches of trees growing at high elevations.[1] The flowers open late in the winter or in very early spring. The staminate flower is ovate, obtuse, about one sixteenth of an inch long, raised at maturity on a slender elongated stipe, and surrounded by numerous broadly ovate scales, which are acute and apiculate at the apex, rounded and obscurely keeled on the outer face and concave on the inner; the connectives are ovate, rounded or short-pointed at the apex, and denticulate. The pistillate flower is oblong, and composed of about twenty more or less broadly ovate acute scales tipped with elongated incurved or short points.[2] The cone is oblong, from three quarters of an inch to an inch long and half an inch broad, with scales which are abruptly dilated above into disks penetrated by deep narrow grooves, usually destitute of mucros, about a third of an inch long and an eighth of an inch wide, and furnished on the inner surface with numerous resin glands. Usually from three to five seeds are produced under each scale; they are about one sixteenth of an inch long and light brown, with wings as broad as the body.

Sequoia sempervirens is distributed from the southern borders of Oregon[3] southward near the coast to Salmon Creek Cañon about twelve miles south of Punta Gorda, Monterey County, California, rarely ranging more than twenty or thirty miles from the coast or beyond the influence of ocean fogs, or ascending more than three thousand feet above the sea-level. In this narrow mountain forest belt, which the Redwood has made the most prolific in the world,[4] it often forms at the north, on moist sandstone soil, pure forests, occupying the sides of cañons and ravines watered by abundant springs, and the banks of streams, the trees being separated by only a few feet, and at the south grows usually in small groves scattered among Pines and Firs, the Madroña, and the Tan Bark Oak. Usually confined to the western slopes of the coast ranges, it is most abundant and attains its largest size north of Cape Mendocino; and south of the Bay of San Francisco it is comparatively rare and usually small, although large individual trees were once scattered throughout the entire Redwood region.

Sequoia sempervirens is the most valuable timber-tree of the forests of Pacific North America. The wood is light and soft, brittle and not very strong; it is close-grained, easily split and worked, very durable in contact with the soil, and susceptible of receiving a good polish.[5] It is clear light red, with thin nearly white sapwood, and contains thin conspicuous dark-colored bands of small summer-cells and numerous obscure medullary rays. The specific gravity of the absolutely dry wood is 0.4208, a cubic foot weighing 26.22 pounds. Largely manufactured into lumber, it is the most common and most valuable building material produced in the Pacific states, and in California is used almost exclusively for shingles, fence-posts, telegraph-poles, railway-ties, wine butts, tanning and water tanks, and coffins. It is largely exported to Australia, the Pacific islands and China, and is now frequently used in building in the states east of the Rocky Mountains, and is occasionally exported to Europe,

[1] Eastwood, *Proc. Cal. Acad.* ser. 2, v. 170, t. 15–17 (*Heteromorphic Organs of Sequoia sempervirens*).

[2] Eastwood, *l. c.* 173, t. 18. — Masters, *Gard. Chron.* ser. 3, xix. 556, f. 86.

[3] What is probably the most northern Redwood grove stands in Oregon, about eight miles north of the California state line on the Chetco River, about four miles from its mouth. The Redwood also grows in Oregon on the Winchuck River, just within the borders of the state.

[4] Alvord, *Garden and Forest*, v. 237 (*The Forests of California*).

[5] Frémont, *Geographical Memoir upon Upper California*, 36, 37 (*Senate Doc. Miscellaneous*, No. 148, 30th Congress U. S. 1st Sess.).

where it is employed as a substitute for red cedar in the manufacture of lead pencils. Logs with curled or contorted grain are cut into veneers, which are valued by the cabinet-maker. In California the bark has been utilized to stuff furniture, and to cover the logs of corduroy roads and of bridges over forest streams.[1]

Sequoia sempervirens was discovered in 1796 by Archibald Menzies, the surgeon and naturalist of Vancouver's voyage of exploration, probably on the shores of the Bay of San Francisco, where it was once common and a conspicuous feature of the vegetation, and was rediscovered by David Douglas. It was introduced into English gardens in 1846 by Karl Theodor Hartweg, and flourishes in the regions of western and southern Europe,[2] and in the southeastern United States, where it has proved hardy in the neighborhood of Charleston, South Carolina. In European nurseries a few abnormal seedling varieties have appeared, and are occasionally cultivated by the lovers of curious trees.[3]

Among American trees the Redwood is exceeded in size only by *Sequoia Wellingtonia*. Towering above its companions in the forest, with its bright colored massive trunk and its lustrous foliage, it is unsurpassed in magnificence by any other conifer, and no coniferous forest of the continent equals in impressiveness, beauty, and luxuriance the Redwood forests of northern California. The demand for the wood of this tree, and its accessibility to tide-water, are rapidly destroying the best forests, which soon will be dim memories only; but the peculiar and remarkable power of the Redwood when cut to reproduce itself by numerous shoots from the stump, which soon attain a large size, and often coalesce, forming circular groves, which mark the site of the original trunk, promises to insure its existence as long as the California coast ranges are bathed in the fogs of the Pacific Ocean.

[1] Kellogg, *Forest Trees of California*, 26.

[2] *Gard. Chron.* ser. 3, vi. 240; viii. 302.

[3] Veitch, *Man. Conif.* 212.

EXPLANATION OF THE PLATE.

PLATE DXXXV. SEQUOIA SEMPERVIRENS.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. A stamen, rear view, enlarged.
4. A stamen, front view, enlarged.
5. A branch, with pistillate flowers, natural size.
6. Diagram of a pistillate flower.
7. A pistillate flower, enlarged.
8. Vertical section of a scale of a pistillate flower, with ovules, front view, enlarged.
9. Vertical section of a scale of a pistillate flower, side view, enlarged.
10. A fruiting branch, natural size.
11. A scale of a cone with seeds, front view, enlarged.
12. A scale of a cone with seeds, rear view, enlarged.
13. A seed, enlarged.
14. Vertical section of a seed, enlarged.
15. An embryo, much magnified.
16. A branch with winter buds, natural size.
17. Cross section of a leaf, magnified.
18. A seedling, natural size.

C.E. Faxon del. *Migneaux sc.*

SEQUOIA SEMPERVIRENS, Endl.

A. Riocreux direct. *Imp. J. Taneur, Paris*

SEQUOIA WELLINGTONIA.

Big Tree.

SCALES of the pistillate flower, usually from 25 to 30, long-pointed. Leaves ovate, acute, or lanceolate, slightly spreading or appressed. Buds naked.

Sequoia Wellingtonia, Seemann, *Bonplandia*, iii. 27 (Jan. 1855); vi. 343; *Ann. and Mag. Nat. Hist.* ser. 3, iii. 165. — Lawson, *Pinetum Brit.* iii. 299, t. 35, 51, 53, f. 1–37.

Sequoia gigantea, Decaisne, *Rev. Hort.* Jan. 1855, 9, f. 1 (not Endlicher). — Torrey, *Pacific R. R. Rep.* iv. pt. v. 140. — Carrière, *Traité Conif.* 166. — Bloomer, *Proc. Cal. Acad.* iii. 399. — Hoopes, *Evergreens*, 239, f. 29. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 437. — Koch, *Dendr.* ii. pt. ii. 194. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 117. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 184. — Lemmon, *Rep. California State Board Forestry*, iii. 165, Frontispiece, t. 19 (*Cone-Bearers of California*); *West-American Cone-Bearers*, 69, t. 12. — Koehne, *Deutsche Dendr.* 44, f. 14, H–K. — Masters, *Jour. R. Hort. Soc.* xiv. 247; *Gard. Chron.* ser. 3, xix. 556, f. 85. — Hansen, *Jour. R. Hort. Soc.* xiv. 306 (*Pinetum Danicum*). — Merriam, *North American Fauna*, No. 7, 340 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 224 (*Bot. Death Valley Exped.*).

Wellingtonia gigantea, Lindley, *Gard. Chron.* 1853, 823. — *Bot. Mag.* lxxx. t. 4777, 4778. — Lemaire, *Ill. Hort.* 1854, 14, t. — Naudin, *Rev. Hort.* 1854, 166; *Fl. des Serres*, ix. 93, t. 892, 893. — Planchon, *Fl. des Serres*, ix. 121, t. 903. — *Floricultural Cabinet*, 1854, 121, t. — J. M. Bigelow, *Pacific R. R. Rep.* iv. pt. v. 22. — Gordon, *Pinetum*, 330. — A. Murray, *Edinburgh New Phil. Jour.* n. ser. xi. 205, t. 3–9; *Trans. Bot. Soc. Edinburgh*, vi. 330, t. 6, f. 8, 9. — Henkel & Hochstetter, *Syn. Nadelh.* 222. — Carrière, *Traité Conif.* ed. 2, 217. — Nördlinger, *Forstbot.* 463, f. — Veitch, *Man. Conif.* 204. — Lauche, *Deutsche Dendr.* ed. 2, 78, f. 14. — Schübeler, *Virid. Norveg.* i. 445.

Taxodium giganteum, Kellogg & Behr, *Proc. Cal. Acad.* i. 51 (May, 1855).

Gigantabies Wellingtoniana, (Nelson) Senilis, *Pinaceæ*, 79 (1866).

The average height of *Sequoia Wellingtonia*[1] is about two hundred and seventy-five feet, and its trunk diameter near the ground twenty feet, although individuals from three hundred to three hundred and twenty feet tall, with trunks from twenty-five to thirty-five feet thick are not rare.[2] During four or five centuries the tapering stem is clothed with slender crowded branches, which are erect above and horizontal near the middle of the tree, and below sweep toward the ground in graceful curves, thus forming a dense narrow strict pyramid. Gradually the lower branches disappear, and those at the top of the tree lose their aspiring habit; the trunk, which is much enlarged and buttressed at the base, and fluted with broad low rounded ridges, becomes naked for one hundred or one hundred and fifty

[1] Dr. C. F. Winslow, who visited the Calaveras grove in August, 1854, proposed in a letter to *The California Farmer*, a weekly journal published in San Francisco, that the Big Tree, if it should be a Taxodium, should be called *Taxodium Washingtonianum*, or if it proved to be the representative of an undescribed genus, that, as *Washingtonia Californica*, it should commemorate the name of George Washington. (See Hooker, *Jour. Bot. and Kew Gard. Misc.* vii. 29.) Neither of these names, however, was ever published technically, and Lindley's and Decaisne's specific name *gigantea* being unavailable from previous use in connection with the other species of this genus, the first available specific name for the largest and one of the most interesting trees of North America is that of the English general in whose honor the genus Wellingtonia was established on this tree.

[2] In the Calaveras grove there are three trees over three hundred feet high, the tallest measuring three hundred and twenty-five feet. The largest tree measured by Muir is standing in the King's River forest, and four feet above the ground has a trunk diameter of thirty-five feet eight inches inside the bark. Muir's examination of the trunk of this tree, which is burned nearly half through, showed that it has lived not less than four thousand years, although the layers of annual growth were in places so contorted and involved that it was impossible to count them all; and he believes that other trees now standing are at least five thousand years old. The layers of annual growth, counted by Asa Gray on the stump of a tree which was cut several years ago in the Calaveras grove in order that the top of the stump might serve as a dancing-floor, showed that it had attained a diameter of twenty-four feet inside the bark in about thirteen hundred years. A tree of nearly the same size, which had been cut down, in the King's River forest, examined by Muir, was twenty-three hundred years old. (See Muir, *The Mountains of California*, 179. See, also, Gray, *Proc. Am. Acad.* iii. 94.)

feet; and the narrow rounded crown of short horizontal branches loses its regularity, and gains picturesqueness from the eccentric development of some of the branches or the destruction of others. The bark of old trees is from one to two feet in thickness, and is divided into flat rounded lobes four or five feet wide, corresponding to the lobes of the trunk, and separating into loose fibrous scales; it is light cinnamon-red, and the outer scales are slightly tinged with purple, which is more conspicuous on the much thinner bark of young trees. The leading branchlets are stout, pendulous, and furnished with numerous slender crowded much-divided rather closely appressed lateral branchlets, forming dense masses of spray; dark blue-green, like the leaves, when they first appear, at the end of two or three years and after the disappearance of their leaves the branchlets are reddish brown, more or less tinged with purple, and covered with thin close or slightly scaly bark. The leaves are ovate, acuminate, or lanceolate, rounded and thickened on the lower surface, concave on the upper surface, and marked with bands of stomata on both sides of the obscure midribs, rigid and sharp-pointed, decurrent below, spreading or closely appressed above the middle, and from one eighth to one quarter of an inch, or on stout leading shoots often half an inch in length; on young seedling plants they are linear-lanceolate, short-pointed, thin, spreading, pilose, often ciliate on the margins, and from one half to three quarters of an inch in length. The flowers, which open late in the winter or in early spring, are produced in great profusion, especially the staminate, which often cover the whole tree, and dust the forest and the ground below it with their golden pollen. The staminate flower, which is usually terminal, varies from one sixth to one third of an inch in length, with ovate acute or acuminate denticulate connectives, and is subtended by broadly ovate scales rounded or acute at the apex, keeled on the back, concave on the inner face, and slightly erose on the margins. The pistillate flower is about one third of an inch long, with from twenty-five to thirty, or rarely from thirty-five to forty pale yellow scales, slightly keeled on the back, gradually narrowed into long slender points, and bearing from three to seven ovules under each scale. The fruit is ovate-oblong, from two to three and a half inches in length, from an inch and a half to two inches and a quarter in width, and dark red-brown; the scales are furnished on the upper side, near the base, with two or three large deciduous dark resin glands,[1] and are gradually thickened upward from the base to the apex, which is only slightly dilated, and is from three quarters of an inch to an inch and a quarter long, and from one quarter to one half of an inch wide, deeply pitted in the middle, which is often furnished with an elongated reflexed mucro, and frequently transversely ridged; at maturity they remain straight and rigid and open only slightly, the cone retaining its original form even when dry. From three to seven seeds are produced under each scale; they are linear-lanceolate, compressed, from one eighth to one quarter of an inch in length, light brown, and surrounded by lateral united wings broader than the body of the seed, apiculate at the apex, and often unequal.

Sequoia Wellingtonia is the largest inhabitant of the American forests, and the most massive-stemmed although not the tallest tree in the world. It grows in an uninterrupted belt, chiefly associated with the Sugar Pine, the Douglas Fir, and the Incense Cedar, from the middle fork of the American River southward along the western flank of the California Sierras for a distance of about two hundred and sixty miles to the head of Deer Creek, the northern limit of this belt being near the thirty-ninth and its southern just south of the thirty-sixth degree of north latitude, and its elevation from five thousand to eight thousand four hundred feet above the level of the sea. North of King's River it appears in isolated groves, sometimes standing from forty to sixty miles apart, and the largest covering an area of three or four square miles; on the rim of the cañon of the South Fork of King's River it constitutes a forest six miles long and nearly two miles wide; and in the broken rugged basins of the Kaweah and Tule Rivers it forms forests which for a distance of seventy miles are interrupted only by deep cañons and attain their greatest perfection on the North Fork of the Tule. Restricted to small

[1] These resin glands are thus described by Muir (*in litt.*): "a dark gritty astringent substance is produced in the cones, and falls out with the seeds, when they are dry, in irregular grains. It is soluble in water, and colors it a beautiful purple. It makes good ink; and letters which I wrote with it twenty years ago are still legible."

isolated groves[1] at the north by the topography of the country and by the unexplained absence of seedlings and sapling plants, its existence at the south is assured by numerous seedlings and by young trees in every stage of development.

The wood of *Sequoia Wellingtonia* is very light, soft, not strong, brittle, and coarse-grained, but very durable in contact with the soil.[2] It is bright clear red, turning darker on exposure, with thin nearly white sapwood, and contains thin dark-colored conspicuous bands of small summer-cells and numerous thin medullary rays. The specific gravity of the absolutely dry wood is 0.2882, a cubic foot weighing 17.96 pounds. Manufactured into lumber, it is used locally for fencing and in construction, and is made into shingles.

More than one white man[3] has claimed the honor of discovering this tree; but the first authentic account of it was obtained from William Lobb, who visited the Calaveras grove in 1854, and succeeded in introducing this Sequoia into English gardens. It is now one of the most universally cultivated coniferous trees in all the countries of central and southern Europe, but while it has grown rapidly, it is already beginning to show that the existing climates of Europe do not suit it, and that this glory of the Sierra forests need fear no rival among the emigrants of its race. It has been also occasionally cultivated in the eastern United States, where it does not flourish, although it has occasionally survived in a few sheltered or peculiarly favorable situations.[4] In European nurseries a number of abnormal forms have been produced, the most distinct being one in which all the branches are pendulous and closely pressed against the stem.[5]

[1] Wherever the Big Trees now grow are long deep depressions in the ground, caused by the fall and subsequent disappearance through decay or through the action of fire, of giant trees of older generations. The fact that such trenches do not exist except in the Big Tree forests and near the Big Tree groves seems to show, as Muir has pointed out, that this tree has not been more widely distributed since the glacial epoch than it now is; and on this hypothesis he explains the isolation of the northern groves by the correspondence of the gaps between them with the beds of glaciers, which continued to fill the broad basins of streams long after the ice-sheet had melted from the intervening ridges. Upon these ridges the first post-glacial Sequoias must have found a foothold in the very places where their descendants are growing to-day, the greatest development of the Big-Tree forest occurring "just where the ground had been most perfectly protected from the main ice-rivers that continued to pour past from the summit fountains long after the smaller local glaciers had been melted." (See Muir, *The Mountains of California*, 195. See, also, Muir, *Proc. Am. Assoc. Adv. Sci.* xxv. 242 [*Post Glacial History of Sequoia gigantea*].)

[2] The wonderful durability of the wood of *Sequoia Wellingtonia* is shown by the fact that it has remained perfectly sound in fallen logs, above which trees have grown for three or four hundred years, and which may have lain on the ground for centuries before the germination of the seeds from which these trees sprang. (See Muir, *The Mountains of California*, 179.)

[3] The first white man who saw one of these trees was probably John Bidwell, the proprietor of the well known Rancho Chico, near Chico, California, a pioneer in California fruit-farming, and in 1891 the nominee of the Prohibition party for President of the United States. In 1841 Bidwell crossed the Sierra Nevada from the east; descending the Stanislaus River, he became separated from his party while hunting, and in the evening of October 20th, when it was too dark to see distinctly, he came upon an enormous fallen tree, which many years afterward he recognized in the tree of the Calaveras grove known as "The Father of the Forest." Bidwell entered the grove, and found a hiding-place for the night near its eastern side without, however, noticing the standing trees, being disturbed, as he supposes, by want of provisions and by the dread of Indians, signs of whom he had seen during the day, and because the trees of the Sierra forests were all new and wonderful to him (Bidwell *in litt.*). Mr. A. T. Dowd, a hunter of Murphy's Camp in Calaveras County, stumbled into the Calaveras grove in the spring of 1852; and a few weeks later Dr. Albert Kellogg exhibited before a meeting of the California Academy of Sciences in San Francisco branches of the Big Tree, which he had received from Mr. J. M. Hutchins, who was living at that time in or near the Yosemite Valley. (See Shinn, *Garden and Forest*, ii. 614.) These specimens were shown by Dr. Kellogg to William Lobb, the English botanical collector, who immediately started for the Sierras, where he secured specimens and two living trees, which he carried to England on the first steamer leaving San Francisco. (See Kellogg, *Trees of California*, 21.)

[4] Several of these trees have lived for many years in the nursery of Messrs. Ellwanger & Barry, in Rochester, New York, where, however, they have grown very slowly. There are small specimens in the Central Park and in other New York gardens, and a tree near West Chester, Chester County, Pennsylvania. This was probably the largest specimen in the eastern states until a few years ago, when a negro cut off the top for a Christmas-tree and ruined its symmetry.

[5] The weeping *Sequoia Wellingtonia*, which is common in European collections, was raised in the nursery of Lalande jeune near Nantes, France, in 1863. (Ed. André *in litt.*)

EXPLANATION OF THE PLATE.

PLATE DXXXVI. SEQUOIA WELLINGTONIA.

1. A branch with staminate flowers, natural size.
2. A staminate flower, enlarged.
3. A stamen, rear view, enlarged.
4. A stamen, front view, enlarged.
5. A branch with pistillate flowers, natural size.
6. A scale of a pistillate flower with ovules, front view, enlarged.
7. A scale of a pistillate flower with ovules, side view, enlarged.
8. A fruiting branch, natural size.
9. A scale of a cone with seeds, front view, natural size.
10. A seed divided transversely, enlarged.
11. Vertical section of a seed, enlarged.
12. An embryo, enlarged.
13. A leaf, enlarged.
14. Cross section of a leaf, magnified.
15. A seedling, natural size.

C.E. Faxon del.

Migneaux sc

SEQUOIA GIGANTEA, Decne.

A. Riocreux dirext.

Imp. J. Taneur, Paris.

TAXODIUM.

FLOWERS naked, monœcious, the staminate panicled; stamens 6 to 8; anther-cells 4 to 8; the pistillate terminal, solitary; scales spirally disposed; ovules 2. Fruit a globose or obovoid woody strobile ripening in one season. Leaves alternate, linear-lanceolate or scale-like, deciduous or subpersistent.

Taxodium, Richard, *Ann. Mus.* xvi. 298 (1810). — Endlicher, *Gen.* 259. — Meisner, *Gen.* 352. — Bentham & Hooker, *Gen.* iii. 429. — Eichler, *Engler & Prantl Pflanzenfam.* ii. pt. i. 90. — Baillon, *Hist. Pl.* xii. 37. — Masters, *Jour. Linn. Soc.* xxx. 24.

Schubertia, Mirbel, *Nouv. Bull. Soc. Philom.* iii. 123 (1812).

Cuprespinnata, (Nelson) Senilis, *Pinaceæ,* 61 (1866).

Resinous polymorphic trees, with furrowed scaly bark, light brown durable wood, erect, ultimately spreading branches, deciduous, usually distichous lateral branchlets, scaly buds,[1] stout horizontal roots, often producing erect woody projections, and fibrous rootlets. Leaves alternate, subspirally disposed, pale and stomatiferous below on both sides of the obscure midribs, dark green above, linear-lanceolate, spreading distichously, or scale-like and appressed on lateral branchlets, the two forms appearing on the same or on different branches of the same tree or on separate trees, deciduous in the autumn or in the spring. Flowers opening in very early spring from buds formed the previous year, and covered with numerous thin broadly ovate concave scales increasing in size from below upward, or in the autumn. Staminate flowers short-pedicellate or subsessile in the axils of scale-like bracts in long terminal drooping panicles, obovate before anthesis. Stamens from six to eight, distichously opposite on a slender elongated stipe; filaments slender, abruptly enlarged into broadly ovate eccentrically peltate membranaceous yellow connectives truncate below, bearing at the base on the inner surface in two rows four or five or from six to nine globose two-valved pendulous anther-cells opening on the back longitudinally; pollen-grains simple. Pistillate flowers scattered near the ends of branches of the previous year, solitary, terminal on abbreviated axillary scaly branchlets, subglobose, composed of numerous ovate spirally imbricated scales long-pointed and spreading at the apex, adnate below to the thickened fleshy ovuliferous scales bearing at their base two erect collateral bottle-shaped orthotropous ovules. Fruit a globose or obovoid short-stalked woody strobile, maturing the first year, and persistent after the escape of the seeds, formed by the enlargement and coalescence of the flower and the ovuliferous scales abruptly dilated from slender stipes into irregularly four-sided thin disks, conspicuously marked when half grown with the reflexed tips of the flower-scales, often mucronulate at maturity, furnished on the inner face, especially on the stipes, with numerous large dark glands filled with blood-red fragrant liquid resin. Seeds in pairs under each scale, attached laterally to the stipe by large pale hilums, erect, unequally three-angled; testa light brown and lustrous, thick, coriaceous or corky, produced into three thick unequal lateral wings, and below into a slender elongated point. Embryo axile in copious fleshy albumen; cotyledons from four to nine, shorter than the superior radicle.

[1] Taxodium rarely if ever forms a terminal bud in the United States, the branches being continued by axillary globose buds, usually two in number, produced in summer or autumn in the axils of the upper scale-like leaves of leading shoots, and covered with numerous loosely imbricated ovate acute carinate scales accrescent and persistent during the summer on the base of the branchlet. The deciduous lateral branchlets, which continue to appear for three or four years, are developed from minute globose buds, covered with linear-lanceolate apiculate green leaf-like scales persistent on the base of the branchlet, and inclosed in two broadly ovate rounded concave membranaceous scales; on the branchlets of the year they are produced in the axils of its primary leaves, and in succeeding years usually close to the small elevated scars left by fallen branchlets. (See Henry, *Nov. Act. Acad. Cæs. Leop.* xix. 101, t. 14.)

Taxodium during the miocene and pliocene times flourished in the Arctic Circle, and was widely distributed over central Europe, which it inhabited until the late miocene period, the interior of North America, Kamtschatka, and the Aleutian Islands, but is now confined to the coast region of the southern United States and to Mexico.[1] Two species are distinguished; one is an inhabitant of the United States and the other of the Mexican highlands.[2]

Taxodium produces wood valued in construction and the arts, and its bark is rich in tannin.[3]

In the United States Taxodium is not seriously injured by insects[4] or attacked by dangerous fungal diseases.[5]

Taxodium can be easily raised from seeds, which germinate at the end of a few weeks.

The generic name, from τάξος and εἶδος, indicates the resemblance of the leaves to those of the Yew-tree.

[1] Heer, *Fl. Foss. Arct.* 12. — Lesquereux, *U. S. Geolog. Surv.* vii. 73, t. 6, f. 12–14ᵃ. — Saporta, *Origine Paléontologique des Arbres*, 89. — Zittel, *Handb. Palæontolog.* ii. 294.

[2] *Taxodium mucronulatum*, Tenore, *Ann. Sci. Nat.* sér. 3, xix. 355 (1853) (*Ind. Sem. Hort. Neap.* 1853); *Mem. Soc. Ital. Modena*, xxv. pt. ii. 203, t. 1, 2. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 441. — Hemsley, *Bot. Biol. Am. Cent.* iii. 185. — K. Koch, *Dendr.* ii. pt. ii. 198.

Taxodium distichum, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 4 (not Richard) (1817). — Kunth, *Syn. Pl. Æquin.* i. 351. — Seemann, *Bot. Voy. Herald*, 335.

Taxodium Mexicanum, Carrière, *Traité Conif.* 147 (1855). — Henkel & Hochstetter, *Syn. Nadelh.* 261. — Beissner, *Handb. Nadelh.* 155.

Taxodium distichum Mexicanum, Gordon, *Pinetum*, 307 (1858).

The Mexican Bald Cypress, which I have seen growing only in the neighborhood of Monterey in Nuevo Leon, where I was unable to distinguish it by habit or foliage from the species of the southern states, differs from this tree in its flowering season, which is the autumn, in the persistence of its leaves during the winter, in its more elongated panicles of staminate flowers, and in its more numerous anther-cells, often from seven to nine in number. The autumnal flowers and more persistent leaves might be accounted for by the warmer climate of Mexico; the greater or lesser number of anther-cells is a character of little stability, and further investigation will probably show that the tree of the swamps of the southern states and the tree of the Mexican highlands are specifically identical, although with the scanty information at my disposal it seems necessary to adopt the opinion of the best European botanists who have seen the Mexican tree in Italian gardens, where it was first distinguished, and consider it specifically distinct.

Taxodium mucronulatum is said to be widely scattered over eastern and southern Mexico, where it grows near streams, and to form extensive forests on mountain slopes. It is best known by a few individuals which have attained a great age and size. The largest of these trees of which authentic measurements are recorded stands within the grounds of the village church in the centre of the little town of Tule on the road from Oaxaca to Guatemala by way of Tehuantepec. According to latest measurements, its trunk at five feet from the ground has, in following all its sinuosities, a circumference of one hundred and forty-six feet, while the actual girth is one hundred and four feet, the greatest diameter forty feet and the least twenty feet. Its height is one hundred and fifty feet, and the spread of its branches one hundred and forty-one feet. It is believed to be two thousand years old.

The Cypress of Montezuma, which is the largest of the Cypress-trees in the gardens of Chepultepec, standing near the spring from which the water-supply of the Aztec capital was obtained, was a noted tree four centuries ago. It is about one hundred and seventy feet high, with a trunk to which different travelers have ascribed a circumference varying from forty to nearly fifty feet. It has been estimated that this tree has lived through seven centuries. In the valley of Peopatella a Taxodium with a trunk about twenty feet in diameter raises its head, now shorn by decay of much of its grandeur, high above the little church built to commemorate the battle in which the soldiers of Cortes went down before the Aztec hordes. (See Humboldt, *Essai Pol. Nouv. Esp.* ed. 2, 54. — A. De Candolle, *Bib. Univ. Genève*, lxvi. 392. — Gray, *Scientific Papers*, ii. 113. — *Garden and Forest*, iii. 150, f. 28.)

[3] Trimble, *Garden and Forest*, ix. 162.

[4] Borers in the living trunks of Taxodium are undescribed, but the larvæ of *Eacles imperialis*, Drury, *Orgyia inornata*, Beutenmuller, *Oiketicus Abbotii*, Grote, and other insects have been found on the foliage. A gall, *Cecidomyia Cupressi-ananassa*, Riley, has been described as abundant on these trees in Tennessee (*Am. Entomol.* ii. 244).

[5] Taxodium in the United States seems to be remarkably exempt from the attacks of fungi. About a dozen species have been recorded upon it, but they are insignificant in their effects. *Sphærella Taxodii*, Cooke, and *Metasphæria cavernosa*, Ellis & Everhart, are the principal parasitic fungi attacking *Taxodium distichum*, the former injuring the leaves and the latter the branches. A species of dry rot in living timber often diminishes its value, and in Louisiana and Mississippi is said to affect at least one third of all the trees. (See Dickson & Brown, *Am. Jour. Sci.* ser. 2, v. 15 (*On the Cypress Timber of Mississippi and Louisiana.*)

TAXODIUM DISTICHUM.

Bald Cypress. Deciduous Cypress.

Anther-cells usually 4 or 5. Leaves dimorphic.

Taxodium distichum, Richard, *Ann. Mus.* xvi. 298 (1810); *Comm. Bot. Conif.* 52, t. 10. — Lambert, *Pinus*, ed. 2, ii. t. — Brongniart, *Ann. Sci. Nat.* sér. 1, xxx. 182. — Loudon, *Arb. Brit.* iv. 2481, f. 2335. — Forbes, *Pinetum Woburn.* 177, t. 60. — Endlicher, *Syn. Conif.* 68 (in part). — Scheele, *Roemer Texas*, 447. — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 207. — Knight, *Syn. Conif.* 20. — Darlington, *Fl. Cestr.* ed. 3, 294. — Carrière, *Traité Conif.* 144. — Morren, *Belg. Hort.* vi. 305, t. 74. — Gordon, *Pinetum*, 305. — Torrey, *Bot. Mex. Bound. Surv.* 210. — Chapman, *Fl.* 435. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 29. — Henkel & Hochstetter, *Syn. Nadelh.* 259. — Hoopes, *Evergreens*, 364, f. 58. — Parlatore, *De Candolle Prodr.* xvi. pt. ii. 440. — Lawson, *Pinetum Brit.* ii. 205, f. 1–9. — K. Koch, *Dendr.* ii. pt. ii. 195. — Nördlinger, *Forstbot.* 460, f. — Regel, *Russ. Dendr.* ed. 2, i. 28, f. 8. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 183. — Lauche, *Deutsche Dendr.* ed. 2, 74, f. 12. — Schübeler, *Virid. Norveg.* i. 374. — Mayr, *Wald. Nordam.* 120, f. 3. — Watson & Coulter, *Gray Man.* ed. 6, 493. — Masters, *Gard. Chron.* ser. 3, vii. 324, f. 49; *Jour. R. Hort. Soc.* xiv. 248. — Hansen, *Jour. R. Hort. Soc.* xiv. 303 (*Pinetum Danicum*). — Koehne, *Deutsche Dendr.* 43, f. 13, A–J.

Cupressus disticha, Linnæus, *Spec.* 1003 (1753). — Miller, *Dict.* ed. 8, No. 4. — Muenchhausen, *Hausv.* v. 149. — Du Roi, *Harbk. Baumz.* i. 201. — Marshall, *Arbust. Am.* 39. — Lamarck, *Dict.* ii. 244. — Wangenheim, *Nordam. Holz.* 43. — Schoepf, *Mat. Med. Amer.* 143. — Walter, *Fl. Car.* 238. — Aiton, *Hort. Kew.* iii. 372. — Castiglioni, *Viag. negli Stati Uniti*, ii. 228. — Willdenow, *Berl. Baumz.* 91; *Spec.* iv. pt. i. 512; *Enum.* 991. — Borkhausen, *Forstbot.* i. 460. — *Nouveau Duhamel*, iii. 8. — Michaux, *Fl. Bor.-Am.* ii. 208. — Schkuhr, *Handb.* iii. 286. — Desfontaines, *Hist. Arb.* ii. 567. — Cubières, *Mém. Cyp. Louisiane*, f. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 449. — Stokes, *Bot. Mat. Med.* iv. 438. — Michaux, f. *Hist. Arb. Am.* iii. 4, t. 1. — Pursh, *Fl. Am. Sept.* ii. 645. — Nuttall, *Gen.* ii. 224. — Hayne, *Dendr. Fl.* 178. — Jaume St. Hilaire, *Traité des Arbres Forestiers*, t. 24, 25. — Elliott, *Sk.* ii. 642. — De Chambray, *Traité Arbr. Rés. Conif.* 349.

Cupressus disticha, var. **patens**, Aiton, *Hort. Kew.* iii. 372 (1789).

Schubertia disticha, Mirbel, *Mém. Mus.* xiii. 75 (1825). — Rafinesque, *Fl. Ludovic.* 151. — Sprengel, *Syst.* iii. 890. — Spach, *Hist. Vég.* xi. 349.

Taxodium distichum, **A patens**, Endlicher, *Syn. Conif.* 68 (1847). — Loudon, *Arb. Brit.* iv. 2481.

Cuprespinnata disticha, (Nelson) Senilis, *Pinaceæ*, 61 (1866).

A tree, with a tall lobed gradually tapering trunk, rarely twelve and generally four or five feet in diameter above the abruptly enlarged strongly buttressed and usually hollow base, and occasionally one hundred and fifty feet in height. In its youth the short and comparatively slender distichously forked branches are erect and spreading, forming a narrow strict formal pyramid; later they are often elongated and slightly pendulous, and as the tree reaches maturity the lower branches disappear, while those above spread out into a broad low rounded crown often a hundred feet across, or, when the trees grow close together, into crowns remarkably narrow in proportion to the height of the tall stems. From the stout wide-spreading horizontal roots woody cylindrical projections, rounded at the apex and often a foot in diameter, rise in great numbers, frequently to a height of several feet above the surface of the ground.[1] The bark of the trunk is from one to two inches in thickness, light cinnamon-red, and

[1] These developments, called "Cypress knees," on the roots of *Taxodium distichum*, are produced when the tree grows in wet places, and vary in size and number with the depth of the water or the amount of moisture in the soil. From fifty to one hundred knees spring from the roots of one tree, rising sometimes to a height of ten or twelve feet in order to emerge from the water; or, when the tree grows on land covered with shallower water or on ground merely saturated with moisture throughout the year, the knees remain low, but increase in number; while trees transplanted to high dry ground often develop small knees, barely rising above the surface of the soil.

W. P. Wilson (*Proc. Phil. Acad.* 1889, 67) has noted that the knees develop by two distinct methods: by the first the roots of seedling plants in wet places, when only six or eight inches below the surface, grow upward at angles varying from twenty to thirty-five degrees, and then on reaching the surface turn and grow downward again at about the same angle; if the soil is very wet or submerged during a portion of the year, some of the roots repeat

divided by shallow fissures into broad flat ridges, which separate on the surface into long thin closely appressed fibrous scales. The branchlets are slender, light green when they first appear, light red-brown and rather lustrous during their first winter, and darker during the following year, when the thin bark separates irregularly into fibrous scales. The deciduous lateral branchlets are three or four inches in length, and spread at right angles to the branch, or in the form with acicular leaves they are pendulous or erect, and often six or seven inches long.[1] The leaves on the distichously spreading branchlets are linear-lanceolate, apiculate, from one half to three quarters of an inch in length, about one twelfth of an inch in width, and light bright yellow-green on both surfaces, or, especially on trees growing toward the southwestern limits of the range of the species, silvery white below; and on the form with pendulous or erect branchlets they are compressed, long-pointed, keeled and stomatiferous below, concave above, more or less spreading at the free apex, and about half an inch in length; in the autumn the branchlets with their leaves turn dull orange-brown before falling. The panicles of staminate flowers are four or five inches long and from an inch and a half to two inches wide, with slender light red-brown stems; the flower-buds are obovate, nearly an eighth of an inch in length, pale silvery gray during the winter, and purple when the flowers expand in the spring. The cones, which are usually produced in pairs at the extremity of the branch, or are irregularly scattered along it for several inches, are nearly globose, or obovate, rugose, usually about an inch in diameter, and generally destitute of mucros. The seeds with their wings are about a quarter of an inch long, and nearly an eighth of an inch wide, but vary considerably in size.

this downward and upward growth several times within a distance of six or eight feet; and at each point where the root approaches the surface of the soil a knee grows from its upper side. By the second method knees are produced by the more active growth of the upper surface of old roots of submerged trees at certain definite points. When the ascending and descending parts of the roots are close together they become, with increased diameter, united in the formation of the knees; several knees which began their growth near together often become consolidated into one; and the root between the tree and the knee is smaller than it is beyond the knee, at the base of which a cluster of roots is frequently developed, later becoming consolidated with it.

The most usually accepted belief with regard to the functions of these root-developments is that they serve to aerate the submerged roots, which, without their aid, would be entirely deprived of air. (See Berkeley, *Gard. Chron.* 1857, 549, f. — Shaler, *Mem. Mus. Comp. Zoöl.* xvi. No. 1 [*Notes on Taxodium distichum*]. — W. P. Wilson, *Proc. Phil. Acad.* 1889, 67; *Forest Leaves*, ii. 110, f. — Lotsy, *Studies Biol. Lab. Johns Hopkins Univ.* v. 269, t. 17, 18.)

The hypothesis has also been advanced that the function of the knees is mechanical, aiding the roots to anchor the tree in the soft muddy ground in which it grows. (See Lamborn, *Garden and Forest*, iii. 21, f. 4. — Shaler, *Garden and Forest*, iii. 57.)

Cypress knees, which are frequently hollow in old age, consist of soft spongy pale fibres, covered with thin red-brown scaly bark, and are exceedingly light, the average of four determinations, two from the top of a large knee and two from the base of the interior of the same knee, giving a specific gravity of only 0.2303. They have been occasionally manufactured into razor strops, which, however, are soon ruined unless preserved from dust, as this adheres to the soft wood and becomes imbedded in the grain. (See *Garden and Forest*, i. 480.)

[1] No one unfamiliar with the fact that branches of the two forms occasionally appear on the same individual would imagine that the Cypress-trees with erect or pendulous thread-like branchlets and closely appressed acerose leaves belong to the same species as those with spreading distichous branchlets and flat leaves. The acerose form, which, so far as I have been able to observe, is not uncommon in South Carolina, in northern Florida, and in the neighborhood of Mobile, Alabama, but does attain a large size, appears to have been first noticed by Nuttall; it has long been an inhabitant of the gardens of the eastern United States and Europe, and is generally cultivated as *Glyptostrobus pendulus*, and believed to be a native of China. The synonymy of this form is: —

Taxodium distichum, var. *imbricarium*.

Cupressus disticha, β *imbricaria*, Nuttall, *Gen.* ii. 224 (1818); *Trans. Am. Phil. Soc.* II. ser. v. 163. — Elliott, *Sk.* ii. 643. — Croom, *Am. Jour. Sci.* xxviii. 166.

Taxodium microphyllum, Brongniart, *Ann. Sci. Nat.* xxx. 182 (1833). — Endlicher, *Syn. Conif.* 68.

Taxodium ascendens, Brongniart, *l. c.* (1833). — Endlicher, *l. c.* 69.

Taxodium distichum Sinense pendulum, Loudon, *Arb. Brit.* iv. 2482 (1838).

Taxodium Sinense, γ *pendulum*, Forbes, *Pinetum Woburn.* 180 (1839).

Schubertia disticha, β, Spach, *Hist. Vég.* xi. 349 (1842).

Schubertia disticha, γ, Spach, *l. c.* 350 (1842).

Glyptostrobus pendulus, Endlicher, *l. c.* 71 (1847). — Lindley & Gordon, *Jour. Hort. Soc. Lond.* v. 208. — Knight, *Syn. Conif.* 21. — Carrière, *Traité Conif.* 152. — *Bot. Mag.* xcii. t. 5603. — Hoopes, *Evergreens*, 369, f. 59, 60.

Taxodium Sinense, Gordon, *Pinetum*, 309 (1858).

Taxodium distichum pendulum, Carrière, *l. c.* ed. 2, 182 (1867). — Veitch, *Man. Conif.* 215. — Beissner, *Handb. Nadelh.* 152. — Hansen, *Jour. R. Hort. Soc.* xiv. 304 (*Pinetum Danicum*).

Elliott (*l. c.*) describes this as a small tree growing in Pine-barren ponds, and producing more numerous knees than individuals of the more common form. He noticed that the branchlets on upper branches were often distichous.

It is possible that it was this tree, which was described by Aiton (*Hort. Kew.* iii. 372 [1789]) and figured by Loudon (*Arb. Brit.* iv.

Taxodium distichum inhabits river-swamps, usually submerged during several months of the year, the low saturated banks of streams, and the wet depressions of Pine barrens. It is distributed from southern Delaware, where it grows on the banks of the Nanticoke River near Seaford, and covers the great swamp of Sussex County at the head of the Pocamoke River, where trees of almost the largest size stood until a few years ago, southward near the coast to the shores of Mosquito Inlet and Cape Romano, Florida, through the coast region of the Gulf states to the valley of the Devil River in Texas,[1] and through Louisiana and Arkansas to southeastern Missouri, eastern Mississippi and Tennessee, western and northwestern Kentucky, southern Illinois, and Knox County in southwestern Indiana. In the south Atlantic and Gulf states, where it attains its largest size, *Taxodium distichum* often covers with nearly pure forests great areas of river-swamps, from which the water rarely disappears;[2] in drier situations it grows with the Red Maple, the Water Ash, the Liquidamber, and the Bay, and in the Mississippi valley its common associates are the Swamp Poplar and the Water Locust.

The wood of *Taxodium distichum* is light and soft, close, straight-grained, not strong, easily worked, and very durable in contact with the soil. It is light or dark brown, sometimes nearly black, with thin nearly white sapwood, and contains broad conspicuous resinous bands of small summer-cells and numerous very obscure medullary rays. The specific gravity of the absolutely dry wood is 0.4543, a cubic foot weighing 28.31 pounds. It is largely used in construction and cooperage and for railway-ties, posts, and fences, and is one of the most valuable woods produced by the forests of North America. Most of the wooden houses in Louisiana and the other Gulf states are made from the wood of this tree, and it is now sent in large quantities to the northern states, where it is used principally in the manufacture of doors, sashes, balustrades, and the rafters of glass houses.[3] From the trunks of the Bald Cypress the Indians of the lower Mississippi valley formerly hollowed their canoes.[4]

The resin which can be obtained from the stems and from the cones is said to possess balsamic and healing properties.[5]

William Strachey, who visited the English colony on the James River in 1610, probably wrote the first account of the Bald Cypress,[6] and it was first described by Parkinson[7] in 1640 from a plant

2481, f. 2336, 2337) as *Cupressus disticha*, var. *nutans*, although I have no means of determining the fact.

[1] Coulter, *Contrib. U. S. Nat. Herb.* ii. 555 (*Man. Bot. W. Texas*).

[2] In the great river-swamps of the Gulf coast, where the Bald Cypress grows to its greatest size, the water is so deep through nearly the whole year that its seeds cannot germinate, and there are no young trees and comparatively few small ones growing up to replace the old ones, which are being fast converted into lumber. Some of the large inhabitants of these swamps must have attained a great age, for the Bald Cypress, after its early years, grows slowly. (See Gray, *Proc. Am. Acad.* iii. 96.) The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is seventeen and three quarters inches in diameter inside the bark, and shows two hundred and thirty-four layers of annual growth, having increased only five and one half inches in diameter during the last one hundred and thirty-four years of its life. When these old swamp trees began their career the seeds from which they sprung must have fallen on ground warmed by the sun, and the present depth of the water beneath them can be explained only by the hypothesis that the whole Gulf coast of the United States is gradually sinking.

The depth of water in these southern swamps prevents natural reproduction, and facilitates the operation of the lumber-getter, who would otherwise be unable to drag the heavy logs through the swamp mud. As the trees when cut alive sink to the bottom of the water and are lost, it is necessary to kill them standing by girdling them the year before the negro wood-choppers, balancing themselves in frail canoes, cut through the stems above their swollen bases, and trim off the branches. This work must be done in winter when the water is high so that the trunks may be towed through the swamps into the rivers to reach the mills.

[3] Two varieties of Cypress wood, the black and the white, are recognized by lumbermen. The former, which is rather harder than the other and is considered more durable, appears to be produced near the base of large trees. But no differences in the habit or in the external aspect of the trees indicate a difference in the color of their wood; and this seems to be due either to the age at which the tree is cut or to unknown individual causes.

[4] "On en fait communément des Pirogues d'un seul tronc d'un pouce & plus d'épaisseur, qui portent des trois & quatre milliers, il s'en fait encore de plus grosses: il y a un de ces arbres au Bâton Rouge, qui a douze brasses de tour & une hauteur tout-à-fait extraordinaire." (Le Page du Pratz, *Histoire de la Louisiane*, ii. 31.)

[5] Charlevoix, *Histoire de la Nouvelle France*, ed. 12mo. iv. 300, t. — Porcher, *Resources of Southern Fields and Forests*, 508.

[6] "There is a kynd of wood which we call cypres, because both the wood, the fruict, and leafe, did most resemble yt; and of these trees there are some neere three fathome about at the root very streight, and fifty, sixty, or eighty foote without a braunch." (William Strachey, *Historie of Travaile into Virginia Britannia*, ed. Major, 129.)

[7] *Cupressus Americana*, Parkinson, *Theatr.* 1477, f. — Catesby, *Nat. Hist. Car.* i. 11, t.

Cupressus Virginiana, foliis Acaciæ deciduis, Hermann, *Cat. Hort. Lugd. Bat.* 207. — J. Commelin, *Hort. Amst.* i. 113, t. 59. — Boerhaave, *Ind. Alt. Hort. Lugd. Bat.* ii. 181.

cultivated in England, where it had been introduced by John Tradescant.[1] It is often cultivated in the parks and gardens of the eastern United States, especially in the form with acicular leaves, and is hardy as far north as eastern Massachusetts. In Europe it has been a favorite ornamental tree for at least a century and a half, and in France, Italy, southern Germany, and Great Britain large specimens, which, however, still retain their juvenile pyramidal habit, are often conspicuous objects in old parks and public gardens.[2] Numerous abnormal seminal forms have appeared in Europe,[3] the most distinct being one with pendulous branchlets closely appressed to the trunk.

The glory of the maritime forests of the south and one of the most valuable and interesting trees of the continent, the Bald Cypress,[4] with its tall massive trunk rising high above waters darkened by the shadows of its great crown draped in streamers of the gray Tillandsia, is an object at once magnificent and mournful.[5]

Cupressus Virginiana, foliis Acaciæ cornigeræ paribus, & deciduis, Plukenet, *Phyt.* 85, f. 6; *Alm. Bot.* 125.

Cupressus Virginiana, foliis Abietis mollibus atque deciduis, Breyn, *Prodr. Sec.* 40; ed. 2, ii. 59.

Cupressus foliis distichæ patentibus, Linnæus, *Hort. Cliff.* 449. — Clayton, *Fl. Virgin.* 119. — Royen, *Fl. Leyd. Prodr.* 88.

Cupressus Americana foliis deciduis, Romans, *Nat. Hist. Florida*, 25.

[1] See i. 20.

[2] Veitch, *Man. Conif.* 214. — J. G. Jack, *Garden and Forest*, v. 232.

[3] Carrière, *Rev. Hort.* 1859, 62, f. 10–12. — Beissner, *Handb. Nadelh.* 152.

[4] *Taxodium distichum* is also called Black Cypress, Red Cypress, and White Cypress.

[5] "The *Cupressus disticha* stands in the first order of North American trees. Its majestic stature is surprising, and on approaching them, we are struck with a kind of awe at beholding the stateliness of the trunk, lifting its cumbrous top towards the skies, and casting a wide shade upon the ground, as a dark intervening cloud, which, for a time, precludes the rays of the sun. The delicacy of its color, and texture of its leaves, exceed everything in vegetation." (W. Bartram, *Travels*, 88.)

EXPLANATION OF THE PLATE.

Plate DXXXVII. Taxodium distichum.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A scale of a staminate flower, rear view, enlarged.
4. A scale of a staminate flower, front view, enlarged.
5. A pistillate flower, enlarged.
6. Diagram of a pistillate flower.
7. A scale of a pistillate flower with ovaries, front view, enlarged.
8. Vertical section of a scale of a pistillate flower, side view, enlarged.
9. A fruiting branch, natural size.
10. A partly grown fruit, enlarged.
11. A scale of a cone with its seeds, side view, natural size.
12. A scale of a cone, its seeds removed, natural size.
13. A seed, natural size.
14. Cross section of a seed, natural size.
15. Vertical section of a seed, natural size.
16. An embryo, enlarged.
17. Staminate winter flower-buds, natural size.
18. Pistillate winter-buds, natural size.
19. Winter leaf-buds, enlarged.
20. Vertical section of a branch with leaf-bud, enlarged.
21. A seedling, natural size.
22. Portion of a branch with acicular leaves, natural size.

C.E.Faxon del. *Rapine sc.*

TAXODIUM DISTICHUM, Rich.

A.Riocreux direx.t. *Imp.J.Taneur, Paris.*

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